The Journal

OF THE

BOARD OF AGRICULTURE

OF

BRITISH GUIANA.

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VOLUME IV.

JULY 1910—APRIL 1911.

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1911.

Terms and Conditions on which Crown Lands in British Guiana can be obtained for the Cultivation of Rubber under the Crown Lands Regulations, 1910.

(1.) The Governor may grant leases of areas of land of any size for the purpose of cultivating rubber thereon for a term of ninety-nine years subject to the following terms and conditions:—

(a.) No rent shall be payable during the first ten years of the lease but the lessee shall pay an annual rent of twenty cents an acre from the eleventh to the fifteenth year inclusive, and an annual rent of fifty cents an acre during the remainder of the lease, and in default of payment of such rent on the day on which the same is due, the lessee shall in addition pay interest thereon at the rate of six per centum per annum for each day of such default.

(b.) During the first ten years of the lease the lessee shall pay the sum of two cents a pound for all rubber, balata, or other substances of the like nature obtained by him from the land, whether from indigenous or cultivated trees.

(c.) The lessee shall each year plant one-twenty-fifth part of the land leased with rubber trees, with an average of not less than sixty rubber trees to each acre, until he has so planted not less than ten-twenty-fifth parts of the said land and shall maintain such cultivation in good order to the satisfaction of the Governor-in-Council.

(d.) In clearing the said land for cultivation no rubber tree or bullet-tree shall be destroyed without the permission in writing of the Commissioner.

(e.) The lessee shall not transfer his interest in the land leased or any part thereof, save with the permission of the Governor-in-Council, but such permission shall not be unreasonably withheld.

(f.) If the lessee employs Aboriginal Indians, he shall keep on the tract a book, which shall be open at all times to the inspection of the Protector of Indians, the Magistrate of the District, and of any officer of the Department, Commissary of Taxation, or Officer of the Police Force and in which shall be regularly entered the name and tribe of every such Aboriginal Indian, the rate of wages allowed, and the amount paid; and all such wages shall be paid in money except with the sanction in writing (which may be either special or general) of the Protector of Indians and shall be paid (as the labourer may desire) either weekly or at the expiration of his contract, or part weekly and the remainder at the expiration of his contract;

(g.) The lessee shall not give or deliver to any Aboriginal Indian any spirituous liquor as an equivalent for, or in payment of, wages or for any work or labour done or performed for him by such Aboriginal Indian.

(h.) The lessee shall place and keep on the façade of the land leased on or near to each boundary paal, a board or tablet on which shall be painted in plain legible letters and figures the name of the lessee, the length of the façade, the compass bearings and depth of the side-lines of the

land, and the number and date of the lease under which he holds it; and the lessee shall keep such board or tablet with such inscription in good repair during the continuance of the lease; and he shall also keep the boundary lines of the land so far as he has cultivated or beneficially occupied it clear and open at all times to the inspection and reasonable satisfaction of any officer of the Department of Lands and Mines.

(*i*.) The land leased shall be subject to the right of way across any portion of it to the Crown lands aback of the said land for the officers and servants of the Crown and Government of the Colony and others thereto authorized by the Crown or Government.

(*j*.) The lease shall not confer on the holder any right to take or obtain mineral oil from any deposit that may exist in or under the land leased and all officers of the Crown or Government and other persons thereto specially authorized by the Government shall at all times have the right to enter such lands for the purpose of obtaining mineral oil therefrom: provided that the lessee shall have the right to compensation for any damage suffered by him in consequence of such entry and the obtaining of mineral oil from the said lands.

(*k*.) If the lessee pays the rent reserved and observes and performs all the covenants and conditions contained in the lease, he shall and may peaceably and quietly possess and enjoy the land leased without any interruption by the Crown or any person lawfully or equitably claiming from or under the Crown.

(2.) If any of the said terms and conditions are not complied with, or the rent is not paid, within fifteen days of the same becoming due, the Commissioner shall have the right to re-enter the land leased and take possession of the same, without paying compensation for buildings or machinery erected by the lessee on the said land.

(3.) If all the terms and conditions of the lease have been complied with, the lessee shall have the right, at any time after the expiration of ten years from the date of the lease, to purchase the land leased at the price of four dollars an acre, and on payment of the said price an absolute grant of the said land shall be made to him, and from the date of such grant the said land shall without exception be in the same position and subject to the same laws and regulations as private lands.

(4.) The fees payable for obtaining a lease, which must be deposited with the application are as follows:

	$ c.
Application	5 00
Survey—	
Areas up to 500 acres—per acre ..	30
Each acre above 500 and up to 1,000	20
Each acre above 1,000	10
These charges include labour, cutting lines, etc.	
Cost of drawing up, executing and stamping lease in Registrar's Office, say	16 20

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Directions to Correspondents.

Notice.—Letters should preferable by written on one side of the paper only, and so far as is possible, each letter should deal with one subject only, to allow of its being referred to the officer who is concerned with the subject.

Officers should be addressed by their titles, not by their names, to prevent confusion with private letters and to ensure that official letters are opened in their absence.

Letters should be addressed—according to the nature of their contents and the business dealt with —to either

The Director,
Department of Science and Agriculture.
Broad Street,
Georgetown.

or

The Government Botanist,
The Botanic Gardens,
Georgetown.

or

The Editor,
The Journal of the Board of Agriculture,
Broad Street,
Georgetown.

or

The Secretary of the Board of Agriculture,
Broad Street,
Georgetown.

Parcels should always contain the name of the sender. If this is not done, it is often impossible to tell from whom they come, in the case of several arriving at the same time.

NOTICE.

THE SCIENTIFIC AND TECHNICAL DEPARTMENT OF THE IMPERIAL INSTITUTE.

His Excellency the Governor desires to call attention to the advantages offered by the Imperial Institute to merchants, planters and others who may wish to have samples submitted to scientific experts for opinion as to their commercial value, etc. The following extracts from a memorandum published by the Authorities of the Imperial Institute will give an idea of the work undertaken and carried on there.

"The Scientific and Technical Department of the Institute has been established to acquire information by special inquiries and by experimental research, technical trials and commercial valuation, regarding new or little known natural or manufactured products of the various colonies and dependencies of the British Empire and of foreign countries, and also regarding known products procurable from new sources, and local products of manufacture which it is desired to export. This work is carried out with a view to the creation of new openings in trade, or the promotion of industrial developments."

2. In an extensive and well-equipped series of research laboratories, a numerous staff of skilled chemists carries out the investigation of the chemical constitution and properties of new dye stuffs, tanning materials, seeds and foodstuffs, oils, gums and resins, fibres, timbers, medicinal plants and products, with a view to their commercial utilization. Whenever necessary, these materials are submitted to special scientific experts, by whom they are made the subject of particular investigation or practical test. Reports are also obtained from technical or trade experts in regard to the probable commercial or industrial value of any such products.

3. The British Guiana Government grants a sum of £150 a year to the Department with a view to the careful investigation and commercial development of the resources of the colony.

The Director of Science and Agriculture is collecting specimens for examination, and the Imperial Institute, which is in very

complete touch with the principal manufacturing and other industries of the United Kingdom, will bring the specimens before manufacturers and others for trial with a view to their commercial development.

It is hoped that this action will do much to help in finding a market for new products and developing the market for those already exploited.

Planters and residents in British Guiana are at liberty to send (through the Director of Science and Agriculture) specimens of little known or new vegetable or mineral products of the colony for examination at the Imperial Institute, by whom a report will be made through the Government Secretary. Specimens should, if possible, consist of a few pounds of the materials, and should be accompanied by full information, especially respecting the precise locality in which the material is found and the extent of its occurrence.

Attention may also be drawn to the "Bulletin of the Imperial Institute," published quarterly, which contains records of the investigations conducted at the Imperial Institute, and special articles on tropical agriculture and the commercial and industrial uses of vegetable and mineral products. Copies of this publication, price 4s. 4d. per annum (including postage), may be ordered through "The Argosy" Company, Limited.

Special sample-rooms have been arranged at the Imperial Institute for the information of inquirers in which materials which have been investigated and valued are available for reference.

Important products of the Colony are shown in the British Guiana Court in the Public Galleries of the Imperial Institute.

THE JOURNAL

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Agriculture in the Tropics.

There are many points of view from which a book on any subject may be written, and in noticing a work it is only fair to the author to consider his declared intention and to judge accordingly. In his recently published volume on "Agriculture in the Tropics" Dr. J. C. Willis, Director of the Royal Botanic Gardens, Ceylon, is careful to announce that no attempt has been made "to write a book for the practical man to use in connection with his actual field work. The effort has been made to produce a work that may be helpful and thought-stimulating for the student, the administrator, or the traveller." The neat volume issued by the Cambiidge University Press cannot be called encyclopædic—it contains some 200 pages only—but it is certainly inspiring. There is much to be learned from its concise and well-worded chapters, and much more that will give rise to serious thought, especially in regard to the application of the author's remarks to local conditions. The general topics of land and soil, climate, population and labour, transport and capital, drainage and irrigation, are excellently treated in a broad and comprehensive style, and the chapters on village agriculture and on agricultural organisation and policy deserve to be most earnestly studied by all interested in any way in such vitally important aspects of this vast subject.

What, for instance, could be better than this :—"The duty of the Government of a country is obviously to encourage agriculture to the utmost, and to make it as attractive as other pursuits, both to the capitalist and to the peasant or labourer. What is wanted is genuine and steadfast encouragement of agriculture, a removal of difficulties from its path, and the adoption of such a policy, and such an attitude towards it and those who pursue it, as will make it

reasonably certain that it shall afford as good prospects as any other form of enterprise to the planter, peasant or labourer. To ensure the end in view it is no use nibbling at the numerous fringes of the problem. A definite policy must be adopted, and the efforts of all the various departments of Government and other organisations directed steadily and resolutely to the carrying out of this policy. The essentially important point to be aimed at must be carefully distinguished from the less essential, and effort directed towards them. And not towards one or two of them only, but towards all at once. There must be full and complete concentration and continuity of effort towards the same end." Dr. Willis has the knack of hitting the nail on the head.

Continuity of effort is particularly emphasised. Concentration carried on steadfastly for long periods of time is the keynote of the policy advocated, and a very sensible warning is inserted.—"It is useless to try to go too fast, and to expect immediate result is more sanguine than wise or reasonable. People in a tropical country naturally tend to look to the Government for all help and progress. It is better to teach them to help themselves, and to help them to do so, though it must be admitted that at present there is little prospect of any voluntary effort producing much result and consequently for many years the work of progress will fall to the Government and to a small section of the agricultural community." "In regard to village and native agriculture generally, the policy should be to lead rather than to drive, though the latter may be employed at times with advantage—e.g. in dealing with outbreaks of disease. The villager should be shown where his advantage lies, and encouraged to grow those things that he prefers, that he understands, and for which he has a good market. Special attention should be devoted to the removal of hindrances from his path—e.g. in the matter of roads, drainage, finance, markets and education." But while thus regarding the native with a sympathetic eye, Dr. Willis does not fail to do justice to the capitalist and to the European planter in the tropics. "Of course the investor from abroad is not there from philanthropic motives: he hopes to 'make his fortune' . . . . In making his own fortune—if indeed he ever does make it—he makes prosperity and wealth for many of the natives of the country and for those who have worked for him. He should receive encouragement, and all obstacles which would tend to drive him to other countries, or check his success in his adopted country, should as far as possible be removed. Every encouragement can be given to all kinds of agriculture without causing mere exploitation of the country."

These brief extracts will suffice to shew the spirit in which Dr. Willis has written his book—a spirit of broad sympathy and toleration founded on a wide experience. It is an ornament to the Cambridge Biological Series and should serve as the type of a class of work of which we can hardly have too much in the future.

Renewing Waterproofs.

To restore a waterproof coat, dissolve a handful of best grey lime in half a pail of water, and with this solution wipe the coat at the hardened parts. This should be done twice, at intervals of about four hours. After this treatment a hardened waterproof laid by as useless for years should be equal to new.—Q.A.J., July, 1910,

Instructing the "Man on the Spot."

The mace is separated from the nutmeg, and both are dried and exported, the tree thus yielding two spices, of which the mace is perhaps the more in demand, so that some years ago an order was sent to a Ceylon planting company from the London office that they were to grow more mace and fewer nutmegs.

—J. C. Willis, M.A., Sc D., in "Agriculture in the Tropics."

The Cash Value of Preventive Medicine.

It may be that the uses of preventive medicine have not yet gripped the popular imagination, but, for the sugar planter who has already availed himself so largely of modern scientific methods the time has come to recognize and apply the means which science has placed at his disposal for preventing the waste of material so expensive as human labour and thereby substantially reduce the cost of his finished products . . . What is required in our industries is the awakening of a Public Health conscience in master and man. I consider that by adopting a broad and well-reasoned policy of sanitary reform on the estates of the colony . . such action will at once improve the efficiency of the labourer himself and will also, in course of time, result in a yearly saving of thousands of pounds now spent uneconomically, if I may venture to say so, in the futile treatment of preventable disease without attempting to remove its causes.

—Dr. G. H. Masson, F. R. I. P. H. (Lond.) in "Proc. Agric. Soc. Trinidad," June, 1910.

Notes.

By Special Request. We have the gratification to announce that the article on "The Cultivation of Limes in British Guiana" which appeared in the last number of *The Journal* proved so popular, and the demand for the number containing it was so great, that it was impossible to supply the demand. Our stock of copies ran out, and at the urgent request of many would-be readers we have reprinted the article in the present issue. This happy necessity gives us again the opportunity of impressing upon readers of *The Journal* the convenience of the method of subscription In that way disappointment is avoided and some idea of our permanent circulation is obtainable for our guidance when ordering our supply.

Strengthening the Library of the Board. With a view to affording every facility for study in the country stations, the Director has caused to be purchased and distributed to Berbice, the North West District and the Pomeroon a series of important works which cannot but be of great value to all interested in the scientific side of agriculture. Among the subjects thus dealt with are "Fertilizers and Manures" and "The Soil," by Mr. A. D. Hall, F.R.S., and "Cocoa" and "Para Rubber" by Mr. Herbert Wright. The library of the Board in the offices in Broad Street is not made nearly as much use of as it might be. New and valuable books are constantly being added and may be seen and read on application. In addition the Director has placed at the disposal of visitors a microscope and a series of slides illustrating some points in elementary plant anatomy and the life history of local insect pests. These last should appeal to candidates who intend sitting for examination next January. It is impossible for the Science Lecturer to illustrate his lectures with the microscope : at Broad Street candidates can study the slides at their leisure.

Waterproof Calico.

To render calico waterproof, a coating of boiled linseed oil containing a little turpentine is a good plan. Another is the alumina soap method. This consists in passing the calico first through a warm soap bath (1lb. to the gallon), then through an alum bath of the same strength, followed by passing the stuff through the mangle. There will be no appearance of any coating, as the alumina soap is in the fibre itself. This metallic soap is excellent for the purpose.

—Q. A. J , July, 19 0.

Cultivation of Rubber in British Guiana.

Considerable interest is now being taken in the cultivation of rubber in the colony. Trials with different varieties of rubber-producing plants have been undertaken by sugar estates in various parts of the colony, by cacao and coffee estates along the Demerara and Berbice Rivers, while plantations have been established in conjunction with provision growing in the North Western District. Many smaller farmer have been trying experiments in the Pomeroon and the Canal districts, while trials have similarly been made in Berbice. In the Board of Agriculture returns for last year nearly 1,000 acres were reported as being under rubber, but this was probably considered less than the total area so occupied. It is anticipated that the returns this year will indicate a satisfactory increase of acreage Many of the sugar estates are contemplating putting in areas under rubber, several companies have lately been formed for the growth of rubber in the colony, the majority being acquired as nuclei properties on which the successful growth of rubber trees had been demonstrated, while at least one of the gold-mining companies contemplates putting a large area of land under rubber in the vicinity of the mines. The growth of the different rubber-producing trees has been carefully watched by the Department of Science and Agriculture and it has been thoroughly demonstrated that large areas in the colony may be considered

EMINENTLY SUITED

to the cultivation of Para rubber, while the experiments at the Botanic Gardens, the Rubber Station at Issororo, at Christianburg, at Onderneeming School Farm, and at Bonasika have already produced results that should be of value to all growers of this product.

Whereas we still have to draw upon the East for a good deal of our information in regard to Para rubber cultivation, yet the data now available from experiments in different parts of this colony and from the various experiment stations make it possible to outline briefly the methods that seem best to be adopted here.

THE BEST LAND FOR RUBBER.

The best results, so far as our experience goes, have been obtained with the growth of rubber on well drained flat lands composed of a mixture of clay and pegass or on the bottom slopes of hills. Experiments have been tried on the heavy clay soils on our coastal region

but the growth of the plants has been very slow even in situations fairly well sheltered from wind and with good drainage. At the back of some of the sugar-estates the results have been more satisfactory, and it is possible that, if suitable land is available at the back of estates, good cultivations of rubber could be established. Particularly might this be the case with some of the river estates. Experiments have also been made with planting in sandy soils but the growth has been very slow; in some instances not being half as fast as in good clay soil in near proximity. Rubber has also been planted upon pegassy lands, but when the land is not thoroughly drained, the depth of pegass is considerable, and there is but a small proportion of clay, the results have been unsatisfactory. [Reference to the article by Mr. H. N. Ridley, Director of Singapore Botanic Gardens reproduced in *The Journal* for January, 1910 (Vol. III, No. 3, p. 156) explains why *Hevea brasiliensis* does unsatisfactorily on peaty or pegassy soils.] Trials are also being made on the laterite hill slopes at Issororo, but it is too early yet to state definitely what the outcome will be. The Para rubbers have grown much slower on the hill slopes than on the flat, and those on the very steep slopes have made but little or no progress. It is possible, however, that with a different system of cultivation to that originally practised, better results will be obtained, as since systematic monthly weedings have been established more vigorous growth has resulted. At the foot of the hills much better growth has obtained, while on the well-drained, flat pegassy lands at Issororo the early growth has been quite satisfactory and compares favourably with that reported from other countries. Excellent growths of Para rubber and Sapium have also resulted on similar types of land in the Pomeroon, Demerara River, Berbice River and Canal districts. Some Sapiums were planted about two years ago on 'Mora reef' land at Christianburg and have grown very satisfactorily, and experiments with Para rubber on similar land are now being undertaken.

Experiments have also been conducted by the Department with planting.

RUBBER IN UNDRAINED SWAMPY LANDS,

with the result, as was expected, that the trees have gradually died out. This method has also been adopted by certain other cultivators with the same result, and now it is generally conceded that on whatever type of land rubber is cultivated it can thrive only with good drainage.

In taking up land for rubber it would be advisable to confine operations, for the present, to flat bottom lands consisting of mixture of clay and pegass, and to the basal slopes of hills, while it

would be advisable to keep sand reefs and the tops of hills covered with original forest to serve as wind-breaks.

Rubber grows most satisfactorily in those districts that possess an abundant and regular rainfall and where there is no well-marked dry season. The total amount of precipitation is not a factor of any considerable weight provided that it exceeds 80 or 90 inches per year but the number of wet days in the year is a factor of great importance in successful cultivation of this product. The importance of this latter factor varies, however, with the type of land that is being cultivated.

THE EXPERIMENTS AT ISSORORO STATION

have been directed to ascertaining whether land for rubber should be completely cleared, whether rubber can be grown satisfactorily in lines cut through the forest, and what results might be expected from planting in the forest. Para rubber and Sapium were planted in bush without any clearing or drainage, but only those that happened to be placed in spaces where they could obtain a fair amount of light have grown at all. A large number of the Para rubbers have died, and hardly a Sapium was alive two years after planting. The same results have also been obtained at other stations. In the forest which had been cleared of small underbush and some of the larger trees, but little growth has been made, and that only in places that are fairly open. The growth in lines cut through the forest has been irregular, only the centre rows making satisfactory progress, while the growth in fully cleared and drained land has been good. It has clearly been demonstrated that for successful and economical cultivation of rubber the whole land should be cleared of the forest growth, and in the case of flat, bottom lands it should be properly empoldered and laid out into beds.

LAYING OUT THE LAND.

In laying out land in rubber it is desirable that the question of economy of labour for the working of the plantation be considered and that the possibility of epidemics of insect pests and fungus diseases should be borne in mind. For Para rubber, it would appear that plantations should be laid out in 100 to 200 acre sections with good forest belts between the different sections, while for Sapium 50 to 100 acre sections would seem, at present, to be preferable to the larger blocks as this tree is liable to attacks from scale insects. The tops of hills should not be bared, nor should very steep slopes be denuded of their forest growth, as the 'wash' on these slopes is so great as to render them after a few years totally unsuited for cultivation purposes.

On flat, bottom, river lands the question of empoldering should be the first to be considered. All lands that are liable to flooding even at spring tides must be empoldered if the best results are to be obtained, and the drains should be of sufficient size to take off all water fairly rapidly. Bush water from non-utilized lands must be prevented for gaining access to the selected area by means of a suitable back trench and dam.

On hilly slopes drainage must also receive consideration, Arrangements should be made for contour drains in order to prevent wash. The waste of humus in newly-cleared forest lands is very great and every effort should be made to prevent this waste as much as possible. Contour drains are excellent for this purpose.

The felling of the original forest should be done carefully and it is good policy to pay a slightly greater price to have proper felling (so that the trees all fall approximately in the same direction*) carried out rather than have trees thrown in every direction. As clearing has to be done before drains can be dug and before planting can be systematically carried on, it is obvious that a considerable amount of time and money may often be saved by careful felling. After felling, the larger trees should be junked up wherever possible in order that good burning may be accomplished. It is not general in this colony to carry out thorough burning, but as much of the original forest should be burnt as possible, as many of the logs take years to decay, and they may be the source of

DANGER FROM FUNGUS DISEASES.

In the East in those localities where root disease is prevalent everything that can possibly be collected is burnt, and stumping is being practised on some properties.

After burning, drain paths are cleared, the flat lands are divided into beds with two-foot drains between them and it seems desirable that 'four-foots' should be liberally interspersed for thorough drainage. At the Experiment Station in the North Western District the new extension is being laid out in ten acre blocks with a 'four-foot' between each block. The nature and situation of the land must of course be the factor that decides at what distance these larger drains should be placed. The width of the beds will also depend upon the nature of the land and upon what distance it is proposed to plant the rubber. After the drains have been dug and the earth backed from their edges it is usual to consider the lining of the field for the rows of rubber plants. If money will allow it, the lines for the plants should be cleared of logs, those that

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*See under "Hints" in *The Journal* for July 1910, (Vol. iv, No. 1, p. 40.)

remain on the land being piled up between the lines cleared for planting. The lining should be systematically carried out in order that the rows may be straight and the plants distributed regularly throughout the fields.

The following estimate of laying out 100 acres of flat, bottom lands has been based upon actual expenses in the North Western District and elsewhere in the colony and should form a reliable guide to all cultivators (actual or prospective) of rubber :—

ESTIMATE

for the establishment of a rubber farm on 100 acres of flat river land leased from the Crown.

FIRST YEAR.

	$ c.
Fees.	
Application fee	5 00
Survey fee, 100 acres at 30 cents	30 00
Buildings, etc.	
Erection of house for Manager	1,000 00
Logie for Foreman and labourers and store house	250 00
Boat and fittings	100 00
Felling and burning forest.	
Underbushing and felling trees at $3 per acre	300 00
Cleaning up and burning off at $6 ,, ,,	600 00
Main drainage.	
Cleaning façade trench path and path for dam and parapet, 24 feet wide, 200 roods at 24 cts.	48 00
Digging façade trench 200 roods 6 feet x 4 feet deep and making up dam 6 feet wide with 6-foot parapet at 56 cts.	112 00
Cleaning paths for back-dam trench, 200 roods, and for side-line trenches 300 roods=500 roods at 24 cts.	120 00
Digging back-dam trench and side-line trenches 4 feet x 4 feet, and making up dam with 6-foot parapet=500 roods at 40 cts.	200 00
Clearing two paths for koker-trench each 40 feet wide, 20 roods at 40 cts.	19 20

Carried forward	$2,784 20
Digging two koker trenches, each 12 feet x 5 feet, 20 roods at $1.20	48 00
Cost of two kokers with doors	30 00
Putting down two kokers	12 00
Drainage of beds.	
Digging bed drains 2 feet x 2 feet, 9,600 roods at 10 cts.	960 00
Cleaning stumps from bed drains, 9,600 roods at 4 cts.	384 00
Plants.	
Purchase of plants, 110 per acre, 11,000 at $30 per 1,000	330 00
Transport of plants and cost of planting at $2 per acre	200 00
Tools and sundries	250 00
Unforeseen at 5%	245 00
	$ 5,243 20
Superintendence.	
Salary of Manager $80 per month	960 00
Wages of two foremen at $16 per month ..	384 00
Total cost 1st year ..	$ 6,587 20

MAINTENANCE, 2ND YEAR.

Superintendence.	
Salary of Manager at $80 per month	$ 960 00
Wages of one Foremen at $16 per month ..	192 00
General.	
Weeding and supplying 100 acres at $7 per acre	700 00
Clearing dams, trenches, etc., 900 roods at 20 cts.	180 00
Clearing small dams at $1.50 per acre	150 00
Purchase and transport of plants for supply ..	50 00
Miscellaneous.	
Tools and Sundries	50 00
Unforeseen	70 00
Total cost 2nd year ..	$ 2,352 00

MAINTENANCE, 3RD YEAR.

Superintendence	
Salary of Manager and wages of Foreman ..	$ 1,152 00
General	
Weeding and supplying 100 acres at $7 per acre	700 00
Clearing dams, trenches, etc., 900 roods at 20 cts.	180 00
Clearing small dams at $1.50 per acre ..	150 00
Purchase and transport of plants for supply	50 00
Miscellaneous	
Tools and Sundries	50 00
Unforeseen	70 00
Total cost, 3rd. year	$ 2,327 00

WIND BELTS.

The importance of wind belts in rubber cultivation is often overlooked. The experiments that have been carried out at the Botanic Gardens have demonstrated that *Hevea brasiliensis* has grown much more vigorously when well sheltered from wind than under similar conditions as regards planting but in more or less exposed situations. Where the trees are exposed to the strong winds of the coastal lands of the colony a marked dry spell of weather has resulted in a general shedding of leaves. The same effect has been noticed in other situations, and it seems fairly definitely established that exposure to wind not only retards growth but often results in frequent change of leaf. Although in some places the retarding of growth may only be slight, it is anticipated that the frequent change of leaf might materially affect the quantity of latex from the trees when the tapping stage is reached. For this reason it is advocated, as mentioned previously, that the tops of the hills should be kept forest clad and that protective forest belts should be left standing between 50 to 200 acre sections of rubber trees according to the kind planted. When it is desired to plant wind belts in a rubber cultivation already established such plants as oronoque (*Erythrina glauca*), local species of *Inga*, Malacca apple (*Eugenia malaccensis*) and *Ficus elastica* (grown from seeds) might be worthy of trial.

THE KIND OF RUBBER TO PLANT.

The trials with rubber-producing trees in this colony have mainly been directed, up to the present, to ascertain what kinds are best suited to our conditions. The results of the experiments carried out by the Department of Science and Agriculture in this direction were briefly summarised in the last number of *The Journal.* They indicate that in the point of growth the indigenous *Sapium Jenmani* and *Hevea brasiliensis* are the only two kinds that can be recommended. The former grows luxuriantly in certain situations in the colony and has done especially well in the North Western District, but in the point of yield nothing definite is yet known in regard to cultivated trees. The experiments at the Bonasika reserve on indigenous trees indicate that, under the systems of tapping tried, yields were obtained which did not compare very favourably with yields obtained from the indigenous Para rubber trees of Brazil. When these experiments have proceeded a short time longer, it is proposed to issue a summary of the results for general information. *Hevea brasiliensis* grows exceedingly well in the colony and the yields obtained from 12 year-old trees at Plantation Noitgedacht indicate that satisfactory yields of rubber may be expected and that a high-grade product can be obtained. Without therefore pledging ourselves to any definite statement in regard to the relative merits of the Para rubber tree and the indigenous Sapium, we are inclined to the opinion that whereas the value of *Hevea brasiliensis* as a rubber-producing tree under cultivation is known in many countries and under different conditions, that of

Sapium Jenmani

has yet to be definitely ascertained ; and whereas the growth of Para rubber has been satisfactory in a very large number of different localities in the colony, cultivators would be wise to choose this variety and to consider Sapium as still being in the experimental stage—worthy of trial only on a small scale until more definite information is available in regard to the yields of rubber that can be obtained from it. An opportunity has recently offered to examine the product of some of our local species of hevea that had been grown under cultivation, and it would appear that the substance they produce cannot be reckoned amongst rubber products required by the market. Details have recently been obtained of the growth of Ceara (*Manihot Glaziovii*) rubber in the Rupununi district of the colony and it would appear that the early growth of this rubber-producing tree in this district is promising and it remains now to ascertain what yields can be obtained from it.

PLANTS.

Hevea brasiliensis is not known to occur in the forests of the colony, and as there are but very few trees of sufficient age under cultivation to produce seeds our supply of plants must, for some years, be obtained from abroad. It is impossible to obtain seeds the germination of which can be relied upon from Brazil, and therefore we have to obtain for the present our supplies from the East. During the last four years 172,957 seeds have been obtained by the Department of Science and Agriculture from the Botanic Gardens, Singapore, from which 134,419 plants have been raised and sold to different purchasers in the colony. Various private attempts have been made with shipments of seeds and stumps from Ceylon, the Straits Settlements and the Federated Malay States, with, so far, but slight success.

The following table gives the details of germinations of seeds of Para rubber at the Botanic Gardens during the two years 1905-7 :—

	Number of Seeds	*Where obtained from*	*Number of Plants raised.*	*Percentage of germination.*
1905-6	50	Para, Brazil	none	—
1906-7	20,000	Received from Messrs. Booker Bros., McConnell & Co. (from Ceylon)	6,000	30
	12,000	Presented by Hon. B. Howell Jones,	none	—
	25,000	Ceylon	1,000	4
	1,200	Botanic Gardens, Singapore	900	75
	500	Royal Botanic Gardens, Ceylon.	100	20

The following table gives particulars of the shipments of Para rubber seeds imported from the Botanic Gardens, Singapore,

by the Department of Science and Agriculture and germinated at the Botanic Gardens, Georgetown, since 1907 :—

1907-8	10,800 (Spring crop)	Botanic Gardens, Singapore.	6,955	64.4
	*52,000 (Autumn crop)	,, ,,	42,100	80.0
1908-9	50,000 (Autumn Crop)	,, ,,	43,150	86.3
1909-10	30,131 (Autumn crop)	,, ,,	21,609	70.0
1910-11	29,676 (Spring crop)	,, ,,	20,465	68.9
	303 (Intermediate crop)	,, ,,	139	46.0
Total 1907-10	172,957	Botanic Garden, Singapore	134,419	77.7 %

It has been demonstrated that the most satisfactory method is to obtain seeds packed in weathered, charred rice dust in biscuit tins direct by parcel post, with about 500 seeds per tin. The autumn crop of seeds has given much better germination than has the spring crop, as much as 86% having been obtained from the former as against 70% for the latter. Germination depends to a very great extent upon the length of time that elapses between the falling from the trees and the packing for transport, as well as upon the skill in packing, while it has been shown that unless the seeds are sown within one week of their receipt in this colony their germinating capacity falls rapidly. Some shipments of stumps from the East have done fairly satisfactorily while others have failed.

*Since the seeds obtained from the Botanic Gardens have been obtained packed in charred rice dust in biscuit tins and sent by parcels post, the average germination of seeds of the autumn crop has been nearly 81% while the average germination of the spring and intermediate crop seeds has been 67·6%. In 1907-8 at the same time as 52,000 seeds were obtained from the Botanic Gardens through the parcel post with 80% germination a shipment of 10,500 seeds obtained by freight was sent to the Botanic Gardens for germination and 18 plants were raised. Several other shipments have been obtained by private firms by freight, and all have resulted disastrously.

THE DANGER OF INTRODUCING DISEASES

in shipments of stumps is a matter that must not be overlooked, and in view of the satisfactory results that have been obtained with importation of seeds under proper conditions of packing and transport we recommend the latter method as being the more practical. With a view to preventing the introduction of diseases through importations of stumps it has been decided by the Board of Agriculture to prohibit their importation except after examination by the Government Botanist. As mentioned in the last *Journal* it may be possible in a year or so to obtain supplies of seeds of *Hevea brasiliensis* fr m Surinam, and later, supplies may be available in Trinidad and other West Indian Islands, but the confusion that existed, and in fact to a certain degree still exists, in egard to certain species of hevea makes it advisable carefully to investigate all supplies of rubber seeds except from the East, particularly as the differences between the seeds of the true Para and other species of hevea that produce no rubber of commercial value are so slight and to a certain extent variable that they often puzzle the trained botanist.

If stumps are imported and they arrive in satisfactory condition, they can be planted directly into their places in the field, but if they appear to have suffered severely on their journey and are more or less dried up it would be more economical to plant them into nursery beds and treat them, after they have made new growth, as nursery plants.

If seeds are obtained, they may be planted directly into baskets, into beds and then transplanted into baskets, or into beds and left for stumps.

In sowing seeds directly into baskets the season of the year must be taken into consideration, as very heavy rains may account for a certain number of the seeds rotting instead of germinating. The soil must be specially prepared and should consist of one half clay, and one quarter humus in the shape of well rotted manure or leaf mould, and one quarter ashes or sand. The baskets should be filled three quarters full, the seed planted about ½ inch deep, and the top of the basket then covered with a thin layer of coconut fibre to prevent wash. The baskets should then be placed in a shady place and watered regularly. Basket plants should be ready for planting into the field between three and four months after sowing the seeds.

SEED BEDS.

The preparation of seed beds in cases where it is decided not to plant directly into baskets, should be carefully carried out.

The position should be carefully selected. The beds should be made in positions sheltered from strong winds. If there are any trees in the place selected they should be trimmed so as to afford a uniform though not dense, shade, but if there are no trees, shading of the beds must be provided by erecting shelters of posts and cross rails lightly covered with coconut or "cokerite" palm leaves. The leaves on these shelters must not be dense, and will have to be removed gradually at a later date in order to harden the plants and accustom them to direct sunlight.

If the place selected is already laid out in two or three-rood beds, such as are found in cane-fields or plantain farms, it will be advisable to run the seed beds across these permanent beds in order that satisfactory drainage may be obtained. All bush or weeds should be removed and the drains thoroughly cleaned. Then the whole beds should be deeply forked and marked off into one rood sections with bed drills two feet wide between the different sections. Each section should be divided into two 5-foot nursery beds with a 2 ft. 4in. footpath in between them for working purposes, while it also be advisable to leave a 2-3-foot parapet along the sides of every alternate drain so that access may easily be had to the beds.

When these sections have been lined out and the shelters erected, the preparation of the nursery beds must receive attention. The soil of the nursery beds should be broken up. Ashes, sand or ground "clinker" from the factory furnaces should be spread on the top of the nursery beds to a depth of ½-1 inch, and at least three or four inches of well rotted manure or leaf mould should then be added. The whole of this addition of sand and humus must be thoroughly worked in the top of the nursery beds to a depth of 6 or 8 inches as it is essential that the soil of these beds should be light and friable and that they when completed should be at least 6 inches above the level of the footpath, in order that efficient drainage of wash-water may be provided.

SOWING.

When the soil of the beds has been well prepared, it should be lightly pressed down by means of a flat board. The seeds should should then be sown and should be placed horizontally with the groove downwards. They should be pressed down gently to a depth of not more than half an inch and should be lightly covered either by means of a small rake or by scattering a thin layer of fine

earth over them. After sowing is finished, the seeds must not be more than one inch deep. They should be sown eight inches apart in rows across the beds that are separated from one another by eight inches. After sowing, the beds must be watered, and the watering must be continued regularly throughout the whole time the seedlings are growing unless sufficient rain is falling. If it is desired to set the seedlings out on an early date, the seeds may be planted closer than 8 inches by 8 inches, and the seedlings when about two weeks old transferred to baskets or boxes. The best time to transfer seedling Para rubber is when the first leaves are beginning to appear, and before the leaves reach more than two inches in length. When it is intended to leave the plants in the beds and to transplant as "stumps" of 1 to 1½ years in age, the seeds should be sown from 10 to 12 inches apart in order to give the plants room for development.

PLANTING OUT.

In newly-cleared forest land the method of making up beds should be similar to that described above except that perhaps so much manure or leaf-mould will not have to be added. The beds may be 100 feet long by 5 feet wide with paths in between. Cross drains between the different series of beds must be provided and small drains to carry off wash-water between every two or three parallel beds. An effort should be made to have the centres of the beds higher than the edges.

The best time to plant "stumps" is when they are 3-4 feet high with a diameter of about half an inch. If they are allowed to grow bigger than this, straight stems cannot easily be obtained. In transferring "stumps" from the nursery beds to the fields they should be cut back 6 inches to one foot to a height of 2 ft. 6 ins. to 3ft. 6 ins., and the roots should be roughly trimmed. They should be taken to the fields in bundles, and on no account must roots that are allowed to remain become dry.

Seedlings in baskets should have their baskets split on both sides and removed before they are planted out if the best results are to be expected.

Holes 18 inches square and 18 inches deep should be prepared with a fork previous to planting out the seedlings or stumps, and in no instance should a hole be dug immediately over an old stump, as progress of growth will be slow and death may result. Stumps that occur where plants are required to be put out should be carefully removed. The expenditure on this labour will be amply repaid in the future.

DISTANCES AT WHICH TO PLANT.

The distance at which to plant out rubber has been fullly discussed, and various arguments and figures have been produced on the question of close planting *versus* wide planting. Closely planted trees do not grow so vigorously as those planted at greater distances apart, and they tend to run up to a great height without making satisfactory yearly incremental increases in girth. The figures, recently published by Mr. H.N. Ridley, show that a number of large trees have in experimental tappings given nearly double the quantity of dry rubber than twice the number of smaller trees yielded. The necessity for vigorous growth and for well-formed trees with good 'heads' of leaves becomes obvious when the future production of rubber is taken into consideration. Closely planted trees are starved and bark renewal is slow and often unsatisfactory. In the neighbouring country of Surinam we saw during our recent visit a considerable number of Para rubber trees closely planted. They were small and stunted, and had but a comparatively small girth. Trees of a similar age planted a good distance apart had made far more satisfactory growth and were vigorous and healthy.

The advocates of close planting claim that larger yields per acre can be obtained during the first few years of tapping and that after the first few years of tapping trees can be cut out to make room for the satisfactory development of the others. This method cannot be considered satisfactory. The trees are starved during their early growth, and it is particularly undesirable from

A PLANT-SANITATION POINT OF VIEW

to have to cut down trees after they have grown for 6 or 8 years. The damage and expense in getting these trees out would be considerable. Mr. Ridley's remarks on this subject should receive careful consideration :—"Estates, therefore, intended to last for a full period of life, say 60 years, should be spaced well apart or they will not continue to yield fully for the whole time. A hundred and fifty large trees planted far apart and allowed to attain their full development are actually more valuable then 500 smaller crowded trees of the same age, though these have a larger tapping area of bark. It may be noted too that not only would they actually produce a large and better quality of caoutchouc but they would also be cheaper to tap." "Trees at 20 years old should be 30 feet apart."

In view of this definite statement based upon long experience with rubber cultivation and upon experimental data, it is extemely

desirable that all rubber cultivations in this colony should be widely planted. For Para rubber, the plants should not be closer than two roods and should be planted in quincunx, but for several reasons it seems desirable that Sapium should be planted somewhat closer and might be 2 roods apart between the rows and 1½ roods apart in the rows.

The question of cost of the labour for tapping will be a matter of prime importance in this colony, and therefore the additional expenditure that will have to be incurred to tap trees closely planted condemns the practice for use in this colony. The question of labour alone should be sufficient to convince cultivators here that close planting is not desirable.

(*To be continued.*)

J. B. HARRISON,

F. A. STOCKDALE.

A Hint.

Now that plant-breeding has almost become an exact science, largely through the application of the principles of Mendelism, comparatively quick results might be forthcoming with which estates could replace worn-out trees or plant additional ground.

—J. Parkin, M.A., F.L.S., in "Science Progress," 1909.

Sanitary Inspectors for Plant Cultivations.

Ceylon has lately established a "Pests Ordinance," under which any dangerous pest may be proclaimed, with the methods recommended for treatment. The employment of these is then compulsory and recalcitrants may be fined in the police courts. This is now (1908), for example, being used against the stem-bleeding disease of coconut palms. Inspectors are appointed for every district in which it occurs. They instruct the headmen in methods of recognizing and treating the disease and with them make lists of all infected places. Notices are then served on the occupiers to take the necessary measures, and the headmen have to see that this is done, and prosecute where necessary.

"Agriculture in the Tropics," by J. C. Willis, M.A., Sc. D.

The Cultivation of Limes.*

The cultivation of limes on the large scale in this colony is a recent undertaking. Two large plantations—one at Agatash, Essequibo, and the other at Providence, Berbice—are already in the making, while others on the Demerara River, in Berbice and in Essequibo are in contemplation. Many small farmers in Essequibo have planted up varying numbers of trees, and an effort is being made to interest the farmers in Berbice to take up the industry, while the Department of Science and Agriculture has lately put in over 15 acres at the Onderneeming School Farm.

There is a large area of loose, friable land in the colony that is suitable for the cultivation of the lime plant, and in view of the interest that is being taken in the crop in various districts of the colony this brief account of the cultivation of the lime, based upon experience in Dominica and Montserrat, and especially upon notes made in this colony, has been prepared for the guidance of intending growers.

While brief mention has been made of the yields that are obtained from cultivations of limes in other countries, it is not possible to make definite statements, in the absence of large cultivations in varying conditions of this crop, as to what yields may be expected in this colony, but judging from the numerous scattered lime trees about the country it is reasonable to expect that yields quite as large as those obtained in other countries will be produced on well-cultivated light lands.

THE BEST LAND FOR LIMES.

Limes grow the most satisfactorily on rich light lands, protected from wind. They grow well on the light, almost sandy, soils of the Essequibo Coast and are doing excellently on the laterite soils at Agatash but they are also being cultivated on the heavier clayey soils in Berbice. Limes are surface feeders and will grow vigorously in shallow soils, but in the heavier clayey soils they are more difficult to establish and require far more careful attention in regard to cultivation than on the lighter, more porous soils.

The excellent growth that limes make on the ferruginous laterite soils in many parts of the interior of the colony indicates that this plant is admirably suited to our lighter lands, and provided that drainage, cultivation, and sheltering from wind are attended to, it should give remunerative returns. On sandy soils drainage can

*Reprinted by special request from *The Journal*, Vol. IV, No. 1 (July, 1910.)

most satisfactorily be carried out, but the question of humus in the soil must be given careful consideration and every effort made to maintain a maximum content. The methods of cultivation of this crop on the various types of soils will vary, and they will be carefully indicated in a later portion of this article. Rich, light, undulating, lands and well-sheltered, will probably give healthier growth and yield heavier crops than other types of land, but limes need not necessarily be confined to this class of soils.

Limes do not grow satisfactorily when exposed to constant winds The trees become stunted, and a very large number of young flowert are blown off when the trees are flowering. In clearing foresr land, it is necessary therefore that the tops of the hills should neve. be bared of bush, as if they are kept well covered with forest growth they form protective wind belts of the greatest value. It is also necessary that lines of wind belts should be left as it will then be *unnecessary to plant rows of trees for wind protection. On flat* land exposed to wind, belts of quick-growing trees must be established to shelter the limes, and for these wind belts the following trees are recommended :—Oronoque (*Erythrina glauca*), Pyrowa wykee (*Inga ingoides*), Galba (*Calophyllum Calaba*), Pimento (*Pimenta officinalis*), Bay (*Pimenta acris*), and Malacca apple (*Eugenia malaccensis*). These should be planted closely together and should be trimmed so as to form dense shelters, but should not be allowed to grow too tall.

RAISING SEEDLINGS.

One of the first matters that has to be given consideration in making a plantation of limes is the raising of seedlings, for while the young plants are growing in the nursery the land can be prepared for them. It is true that in favourable situations lime seeds can be planted at stake in the cleared fields, but it is now generally recognised that raising seedlings in the nursery and then transplanting them into the prepared fields is the safest method to adopt.

On heavy clay soils, the young plants cannot satisfactorily be raised in nursery beds, as the growth is generally slow. They should be grown in boxes and be either transplanted into baskets before being taken to the field or be transplanted directly from the boxes into the land. The preparation of the soil should be carefully carried out. It should consist of two parts of soil, one part of sand or ashes, and one part of leaf mould or properly decayed manure and proper provision should be made for the drainage of the boxes. If the soil is very heavy, a slightly greater proportion of

sand or ashes should be used, while an addition of very fine burnt earth assists in keeping the soil porous in order that proper drainage may be secured. The boxes should be about 6 inches deep and at the bottom of each, after holes to afford drainage have been bored, should be placed a thin layer of small stones and then a layer of cane trash or dried grass. The prepared soil should be added to a depth of three or four inches, and it should be smoothed off level preparatory to sowing the seeds.

Seeds should now be selected for sowing, and should be washed on a fine sieve until all the mucilage has been removed in order to prevent rats from destroying them. Now dry the seeds in the shade and when sufficiently dry sow them in the boxes. If it is decided that the seedlings shall be basketed when they are about 3-4 inches in height, the seed should be sown in rows about 4 inches apart with a distance of about one inch between the seeds in the rows, but if it is contemplated to allow the seedlings to grow in the boxes until they are fit to be placed in their positions in the field they should not be planted closer together than 6 inches, and in rows 6 inches from each other. After the seeds have been sown about ¾-1 inch of fine soil should be lightly spread over them, and the boxes watered and placed in a shady place, on stones or pieces of wood or upon shelves, so that the bottoms of the boxes do not touch the ground.

On light lands, it is unnecessary to provide seed boxes. Seed beds can be used and are far less costly than the boxes.

The land chosen for seed beds should be fairly rich, and should be sheltered from wind. The soil should be thoroughly forked and broken up and made up into beds about 4 feet wide, with paths 2-3 feet wide in between the beds, the height of the bed being about 6-8 inches. High beds afford better drainage, and the young plants grow more vigorously. Two systems of growing seedlings are in vogue, the one in which the seeds are sown thickly in the seed beds and the seedlings transplanted into nursery beds when about 4-6 inches high and the other in which the seed is sown more widely apart in the seed beds and the seedlings obtained are then allowed to remain until they are ready to be put out into the fields. Both methods have given equally satisfactory results but they have never been tested comparatively side by side, but if sufficient suitable land is available for seed beds the less cost of the second method might incline many planters in its favour. In Dominica the former method is usually advocated while the latter has found more general favour with local cultivators.

In the former method, lime seeds are washed, dried in the shade and then sown thinly in drills about 8-9 inches apart running across the seed beds. The drills should not be more than 1 inch deep, and the seed must not be sown too thickly. As the seedlings reach from 4-6 inches high thay are transplanted 8-9 inches apart into the nursery beds in rows about the same distance from one another. The nursery beds should always be tilled to a good depth and should be carefully levelled, and the seedlings as they are taken out of the seed beds to be transplanted into the nursery beds must be handled carefully. They should be lifted gently with small forks, the tips of the roots should be cut off, and the tops of the stems cut back about 1 inch. On no occasion should the roots of the seedlings be exposed to the sun or allowed to become dry. If seedlings cannot be taken immediately from the seed beds to the nursery beds, their roots should be kept watered and covered with damp grass or bagging. The young seedlings are now allowed to grow in the nursery beds until they are about 18 inches high when they are ready to be placed into the field.

In the second method, the seeds are washed, dried in the shade, and then planted, three seeds in the hole, in holes about 1 inch deep 6 to 8 inches apart, in rows 8 to 10 inches from one another. If all the seeds germinate, the smaller and weaker plants are pulled out when they are about 3 to 4 inches high and thrown away, while the young plants that are left should have the earth gently pressed around them if it has been at all disturbed when the other seedlings were removed. The plants are allowed to remain in these beds until they are from 24-30 inches in height when they are ready to be planted in the fields.

PLANTING INTO THE FIELDS.

The land chosen should be prepared and carefully lined. Forest lands have to be felled, cleared and burned before they can be lined out for planting, while land which has previously been in cultivation should be thoroughly forked. Drainage is a question that must receive attention, as limes will not thrive on lands that are not well drained. Even hill slopes should be drained by contour drains, for they serve to make the land more porous and they also assist in helping to stop much of the wash down the slopes. In all steep positions, these contour drains are of very great importance. On heavy lands good and deep drainage is absolutely necessary or otherwise the limes make an unsatisfactory stunted growth, while the leaves are always yellowish. After drainage has been arranged

for, the land should be lined out for planting. On good flat lands the rows should not be closer than 18 to 20 feet, and the plants in the rows should be at least from 16 to 18 feet apart, while on many lands in the interior where limes grow luxuriantly they should not be planted closer than 2 roods by 2 roods. On hill slopes limes may be planted 15 feet by 15 feet or 16 feet by 16 feet as the trees do not grow so large as on the more fertile flat lands. When the land has been carefully lined out, holes 18 inches square and about 18 inches deep should be opened out, at each of the pegs. These holes should remain open for some time and should then be filled with thoroughly broken up earth to such a height that a small mound about 1 foot high is made, so that the earth does not settle down and form a depression in which water can lodge.

When the land is ready for planting the young plants should be lifted from the nursery beds with forks. In Dominica, this is usually done when the plants are from 16-18 inches in height, but the experience at Onderneeming and at other places in this colony indicates that plants 24-30 inches high grow more satisfactorily when planted out than do the smaller seedlings. In any case, about 4-6 inches should be cut off the stems of the plant and the tips of the roots should also be removed.

The plants should always be planted out at about the same depth as they grew in the nursery beds. This depth is shown by the colouration of the stem, and the level of the ground of the nursery beds can easily be observed. When seedlings are in baskets, the basket should be split on both sides with a knife and taken away from the ball of earth carefully, and then the seedling should be planted out. The roots should not be disturbed, nor is it necessary to do more than pinch back the ends of the shoots of the plant. It is not advisable to plant out the seedlings in the basket, only splitting one side, as the basket takes some time to rot and therefore the plant makes unsatisfactory progress and becomes stunted.

CULTIVATION.

Lime trees may give a few fruits in the second or third year after planting and give steadily increasing ones in succeeding years, but it is generally recognised that full crops cannot be expected until the trees are eight or nine years old. It is, therefore, possible that in some localities profitable crops of cassava, pigeon peas, or provisions may be raised between the lime trees provided that these catch crops are not planted too close to the lime plants or so thickly as to injure them. In newly-cleared land, pigeon

peas should be scattered over the land, as they tend to shade the soil and prevent excess of wind gaining access to the young limes, while on level lands sweet potatoes may also be planted. On hilly slopes, it is always advisable not to plant such crops as have to be dug up, as this operation loosens the soil and a considerable amount of waste by rain-wash takes place. It is becoming more and more recognised that on hilly lands an attempt should be made to encourage a 'sod.' Grass and low-creeping weeds should be allowed to grow, and where there is any difficulty in this direction cover crops of low-growing plants should be sown, as they tend to bind together the upper layers of the soil and thus prevent wash. After this 'sod' has been established, a gradually increasing area should be kept clean around each lime tree as it develops, and the grass or weeds that are cutlassed down between the trees should be applied as a mulch to the soil around the trees. It will be found that bush grows rapidly in newly-cleared land. This should always be kept down or otherwise it kills out the grass and low growing weeds, and therefore when cleaning is carried out the soil is again exposed to the rays of the sun and to the wash of the rains. There can be no doubt that the best policy to pursue is to endeavour at the outset to obtain a good 'sod' of grass and low-growing leguminous weeds. On some occasions, it has been noted that grass has been very slow to establish itself in new clearings. Here seeds of grasses and leguminous weeds (such as 'sweethearts'—*Desmodium* spp.) should be scattered as soon as the lime plants are put out. Mulching should be continuously carried on, and whenever any bush or weeds are cut down they should be placed around the trees in a ring coinciding with the outermost branches. It is worse than useless to pile up mulch, as is frequently noticed, round the stems of the trees; it is better to place this mulch too far away from the tree than too close to it, as mulch close to or touching the trees favours the development of disease in the collar of the tree.

On heavy clay lands, the soil around the trees must be tilld at least twice a year so as to keep it loose and friable while mulchings must be carefully carried out, particularly in the dry season. Grass and weeds must not be allowed to grow near the trees, or otherwise unsatisfactory growth takes place.

COVER CROPS.

The question of cover crops is worthy of careful consideration at the hands of lime growers. Low-growing leguminous plants are to be favoured. The different species of *Desmodium* and *Canavallia*

ensiformis and *Tephrosia purpurea* are all worthy of trial, while it is possible that cow-peas could also be used to advantage in some places. For the treatment of weeds in permanent crops readers are referred to the article in *The Journal* of April, 1909 (Vol. II, No. 4).

Too much stress cannot be laid upon the importance of keeping up the humus content of the soil. This can be done to a very great extent by careful mulching, but pen manure should also be applied wherever it is available. Limes pay for liberal treatment, and are then much better able to withstand attacks of scale insects or diseases. Most planters of limes are now paying particular attention to the applications of mulchings and pen manure.

A CAUTION.

In some places, more especially on the laterite and the sandy soils of the colony, it may become desirable to manure the trees with artificial manures. Great caution is necessary with regard to this, as applications of active nitrogenous manure, although apparently favouring the general heal h of the tree and more especially its leaf production, may for a time greatly reduce its flowering and fruit-bearing propensities. Our light soils are not unfrequently very deficient in potash and in lime, and it is these constituents of plant food that may be the first to fail during lime cultivation. If from the appearance of the trees the desirability of application of artificial manure is noticed, a mixture of sulphate of potash with either very finely ground slag phosphate or basic superphoshate should be tried. Probably an application per acre of 1 cwt. of sulphate of potash mixed intimately with 1 cwt. of basic superphosphate and lightly forked into the soil near the margin of the cleared area round each tree will prove useful and remunerative. If applications of nitrogen appear advisable, light dressings of say not more than 80 lbs. of nitrate of soda or 100 lbs. of nitrate of lime per acre should be scattered over the surface of the soil in a s'milar position to where the mixed manures are directed to be applied.

PRUNING.

Lime trees require to have all long suckers removed, and also all dead branches. Beyond that they usually require but little pruning. It has been observed , however, in this colony that in some localities the limes tend to branch very low down at an early stage. All these low branches must be removed, and an effort made to make the tree grow upwards, as otherwise considerable

difficulty will be experienced when picking the fruit is being carried on, as the pickers will not, with ease, be able to get under the trees. All prunings should be taken away and burned, and all wounds carefully tarred with coal tar.

PESTS AND DISEASES.

The following pests and diseases of the lime plant have been noticed in this colony, and require to be carefully watched :—

Acoushi Ants.—These ants often play havoc in the nurseries and frequently in the plantation unless they are watched for. In one night they will strip off all the leaves of the seedlings in a nursery bed or strip many trees in the field. When trouble is experienced with these pests, their nests must be looked for, and destroyed either by 'puddling' with water or by poisoning with carbon bisulphide (See *Journal* of April, 1908, Vol. I, No. 4,)

Scale Insects.—The mussel scale (*Mytilapsis citricola*) is common in some localities, and if left uncontrolled may occasion a great amount of damage. This scale has caused the greatest damage in the lime plantations of Dominica and Montserrat, and its occurrence should be most carefully watched for. It can be kept under control by the use of Rosin compound, and any young trees affected should be immediately sprayed or otherwise they will become sickly and dwarfed. Rosin compound, as described in *The Journal* (Vol. III, No. 1.) is made up as follows :—Mix 4 lbs. of powdered rosin and 3 lbs. of powdered washing soda in 1 gallon of water. Boil and when all is dissolved, make up to 5 gallons. Boil the mixture until it becomes of a clear brownish colour and allow to cool. This may be called the stock solution and for use, it is necessary to dilute 1 part of this stock solution with the addition of 5 parts of water. Knapsack sprayers are the most handy and may be procured at a small cost. The 'Success,' 'Antipest,' and 'Eclair' have given satisfactory results in this colony.

The orange snow scale (*Chionaspis citri*) has been noticed in some places and should be watched. It is most prevalent on the heavier lands, and is almost entirely confined to the trunks and thick branches of trees. This scale is best controlled by painting the affected parts of the trees with rosin compound by means of a small and fairly stiff paint brush.

A species of *Lecanium*, generally followed by black blight, has

scales, such as the red scale, *Aspidiotus articulatus*, and the brown shelled scale (*Lecanium hemisphaericum*) have been found on limes in this colony, but do little damage except on the heavy clay lands. They can be controlled by spraying.

Gummosis.—Gumming of lime trees has occurred on the heavy clay lands of the colony. This is a disease due to some disarrangement of the physiological functions of the plant. Masses of gum exude through the bark, generally at about the level of the ground, the bark gradually dies, and when the stem has been entirely circled the death of the tree results. Generally some condition of soil or drainage is defective, and attention to these matters may check the gumming. It is possible to save some of the trees that show signs of gumming near the level of the ground by cutting out the dead and dying bark and then moulding up the tree with friable soil so that a new ring of roots may be sent out from the collar with which the plant may continue life.

Gumming is a difficult trouble to fight and readers are referred to the brief abstract on the "Gum Troubles of Citrus Trees" given in Vol. III, No. 1 of *The Journal*.

YIELDS.

The yield of fruit from a tree varies according to situation and cultivation. On well-cultivated estates in Dominica the average yield per acre is about 160 barrels of fruit per annum, but yields of as much as 200 barrels are not uncommon in some years on the best estates. Taking the average, it is reasonable to suppose that, with the average cultivation, from ¾ to 1 barrel of fruit per annum should be obtained per tree, although it is possible that with better cultivation in favourable localities larger yields may be expected. The present market price of a barrel of limes in this colony is 72 cents and therefore a lime tree in full bearing might be expected to bring in a return of from 2s. 3d. to 2s. 9d. per annum, after deducting the cost of picking. Seeing that the cultural operations required in full grown orchards are very few, it is obvious that this industry should prove a very remunerative one for many of our small farmers whose land is of a loose friable character.

J. B. HARRISON.

F. A. STOCKDALE.

July 20, 1910.

A Freak in Rubber.

It is perhaps a platitude, but it is a platitude that is well worth "rubbing in," to say that even the most "experienced" planters know very little indeed about the history of the Para rubber tree, or *Hevea brasiliensis*. We are, in fact, only just beginning to learn something of the effects that varied conditions have upon this tree, how it behaves in certain circumstances and the response that it makes to different kinds of treatment. And the reports received from one quarter are often in direct contradiction with those received from another equally trustworthy source. With regard to practically every feature of the cultivation of rubber expert opinions differ, and the more experienced the planter the readier he is as a rule to confess that, like his fellows, he is working very largely in the dark. Take, for an instance, the question of wide *versus* close planting. For several years, basing our arguments on the fact that the *Hevea brasiliensis* in its own country is a forest tree that sometimes attains a very large size indeed, and knowing, because we have seen it, that trees planted a good distance apart do show greater girth—and therefore more tappable area—than those planted closely, we have advocated wide-planting. And, because it seemed natural to allow a tree, like an individual or an animal, to develop and grow before calling upon it to submit to processes which in themselves are unnatural, we have advocated late tapping. And now we hear of trees, that were planted very wide apart and allowed to attain their full growth before being tapped, which have yielded practically no latex at all; while others planted close together and tapped for all they were worth have in successive years given phenomenal yields. There is a well-known block of a few acres on Caledonia estate, marching with the railway line and quite near the station. The trees here were planted some time ago, more with the idea of filling in an unsightly swampy piece of ground than for profit, and the distance apart at they were placed was, roughly, ten by ten. For several years this block was pointed out by passengers in passing trains as an "awful example" of the effects of close planting. The trees were certainly not much to look at, being abnormally tall, weedy in appearance, and of very slight girth. Moreover they were subjected to all kinds of experiments in the way of pruning, topping and tapping, besides which the soil is by no means ideal for rubber—always according to the experts. And yet that block yielded last year at the rate of 900 lb. of dry rubber per acre! Such results as these, which, though opposed to all presumption and experience, are by no means isolated,

must cause Managers to revise their views with regard to some of the most essential features of rubber cultivation. They certainly emphasize the need for a thoroughly well-equipped and efficient Department of Agriculture, with an experienced staff and ample funds, which would be capable of collecting, comparing and co-ordinating the results obtained in practical work. The F. M. S. Government will during the next few years obtain a very large revenue indeed from the export duty on rubber. In its own direct interest, besides that of the planting industry, it should be prepared to spend money generously on scientific arboricultural research work. But it will be little use doing this if there is no continuity of policy about the Department. At present there is no Director of Agriculture at all, and Mr. Gallagher only held the appointment for a few months before he resigned. It is essential, if the Government is to retain the services of capable officers in this branch of administration and the country to benefit by their experience, that the authorities should wake up to the facts that conditions have changed vastly during the past few years and that if they wish to make the Department a real factor in the prosperity of local agriculture they must be prepared to remunerate the staff according to a revised and enhanced scale.

—Penang Gazette, June 24, 1910.

Lemon Grass and Sleeping Sickness.

The "Journal d'Agriculture Tropicale," No. 104, contains an account of a use for lemon grass that is under trial by the Government of Uganda. This consists in the cultivation of lemon grass, not merely as a source of essential oil, but as a prophylactic measure against sleeping sickness, which is especially prevalent among the natives who live on the shores of Lake Victoria-Nyanza. This plant, through the vapour of essential oil which it constantly produces, repels the greater number of insects, particularly the fly by which the disease is transmitted.

From the account, it appears that the grass is cultivated as a border, about 300 yards broad, around the margin of the lake. Grown in this way, it improves the sanitary conditions, lessens the erosion of the soil, and yields, when cut, a profitable amount of oil. It is suggested that this use of the grass should be extend to other colonies in tropical Africa.

—" The Agricultural News," Barbados, May 14, 1910.

School Gardens.

In connection with the annual "College Day" celebration, Mr. M. E. Couchman, I.C.S., Director of Agriculture, Madras, delivered an interesting and instructive address on "School Gardens" to the students of the Madras Teachers' College at Saidapet. In the course of his address he said :—

'The general ground on which I base my appeal for more school gardens is, I need hardly tell you, that I regard the Educational Department as an undeveloped adjunct of the more important Department of Agriculture. In order that the Agricultural Department may experience less difficulty in persuading the next generation of cultivators to adopt more up-to-date methods in their cultivation, the Educational Department must make the first approaches when they are young, when, as your syllabus says, 'the habits of thought, feeling and action are formed, and when perception, observation, and attention are likely to be more active.

In no other calling are these qualities more necessary than in that of a farmer. In no other profession is the error of confounding the process of passing examinations with the acquisition of real knowledge more likely to lead to

DISAPPOINTMENT, IF NOT DISASTER.

I shall arrange the remarks which I am going to make to-night under two general heads first, the reasons why more and better school gardens are desirable in Madras, and second, what they should and should not try to do and be.

"There are two main defects in the mental equipment of the educated classes of this country, so widely spread that I might also go so far as to call them national characteristics—the habit of identifying book-learning with knowledge, and the want of observation of, and the general indifference to, external nature. When you ask a man what he has learnt, he usually tells what standard he has studied up to, or what examinations he has passed, not what he knows. Knowledge seems to be almost regarded as a means to an end, i.e., to the obtaining of a certificate. Hence we see such strange cases as men, who have studied Botany or any of the other natural sciences, going on to the study of law, with the intention of following the profession of vakils. And when you ask anyone how he likes a new place of residence, the reasons which he gives for liking or disliking it, when they are not closely connected with his

health, such as the food and the water, are usually limited to the cost of living or the conveniences available for the education of his children. In a similar case the European would usually give at least some place to the natural amenities of the locality. As regards the habit of confusing book-knowledge with knowledge in the proper sense of the word, I would first point out that

WORDS ARE ONLY SYMBOLS OF REALITY.

In particular, the natural sciences have no meaning or interest apart from the material world of nature, whose properties and movements they describe. To study any of the physical sciences, therefore, without connecting them at every step with reality, is a mere waste of time.

" In the past few years I have been brought in contact with men who have had some training in physical science, and I have noticed that it is not an uncommon thing to find that they have not really connected the sciences they have learnt with the real world. Their interest in science ceased with the class-room, or rather with the examination room. During the rest of their lives they have been witnessing and taking part in a continuous series of chemical and biological experiments, without being aware of the fact at all, reminding one of the man who was surprised and delighted to be told that he had been talking prose all his life without knowing it.

" Now in the case of the school garden, this point of view is very clear. It affords a ready means of connecting the study of elementary physical science with the realities which the books deal with. It forms a bridge from the theory of botany, chemistry, and physics to the real world; to those fields in which the parents of your future students toil to gain their living. If I were to go further, and discuss

THE METHODS OF NATURE STUDY,

as it is called, I should be venturing out of my depth. The Madras scheme of studies for elementary schools for boys summarises the aims of nature study as follows :—" Instruction proceeds from study of the actual object rather than from description or reading. The aim is not so much to impart information as to lead the children to find out for themselves all that they can about familiar and natural phenomena."

" Much might be said on the second point, the strange indifference of educated Indians to external nature and the beauties of their country. This may be due in part to the attraction which

metaphysics has always had for the Indian mind, to the exclusion of interest in the world of nature. I should be the last person to deny the importance of metaphysics, but in the Kaliyuga in which we are living we are under the necessity of taking our part in the drama of this world, or farce, if such it is, and therefore we cannot afford to ignore the world in which we live. On the other hand, this indifference may have a less exalted source. It may be simply due to neglected and undeveloped powers of the mind. Among the characteristics of infancy and childhood enumerated in your syllabus are "impressibility, imitativeness, and memory." The mind of the child attending an elementary school could not fail to be impressed with the appearance of

A GOOD SCHOOL GARDEN.

He would wish to have a small garden of his own at home, and the habit of looking at and attending to a garden might stick to him all through his life. One of the most incongruous things about the residences of many wealthy Indians, at all events of this Presidency, is the contrast betwen the scrupulous care and attention paid to their personal cleanliness and personal appearance, and the squalor of the land surrounding their houses, which might be a garden, but which it would be flattery to describe as anything better than a piece of waste land enclosed by a wall. It would be no small gain if the habits of neatness, order, and a taste for beautiful surroundings could be inculcated in the mind of the child when he goes to school.

"A taste for a garden is not a mere hobby, to be put on a plane with photography, or any game or amusement. Looked at from the most practical point of view, it would add greatly to the pleasure of life if those who had the time and money to do so, would beautify their surroundings, and bring pressure to bear on those entrusted with the care of public places to make them less unsightly than they are at present. How many Jubilee Parks and Queen Victoria Memorial Gardens in this country would then be placed where the public could recreate themselves in their spare moments with the sigh of well-kept and beautiful grounds. At present in too many cases these places are

NEGLECTED WASTES

if nothing worse. From the public point of view, then, there is a good deal to be said in favour of any attempt to arouse more, interest in gardening. From the point of view of the individual gardening provides a pleasant recreation, and gives an interesting

and harmless occupation to those who have nothing to do with their spare time. Everyone who has any knowledge of village li e in this country knows that the want of occupation during the season when there is no field work going on is the main cause for half of the petty intrigues and criminal and civil disputes which flourish in the off season. I suggest that a taste for gardening inculcated in the children of the village might lead to a diminution of these mischievous quarrels, which are the bane of Indian life. There is such a thing as a too exclusive attention to the affairs of one's neighbours. It is true that the proper study of mankind is man, but there are other objects which repay attention. Without going so far as the famous Head of a Cambridge College who is reported to have said, after attending a long and acrimonious College mee ing, 'the more I see of men, the more I like dogs,' there can be no doubt that one strong argument for gardening is that it constitutes an occupation

FREE FROM THE ENVY,

hatred and uncharitableness which are too commonly the fruit of seeing too much of our fellow-creatures.

"Passing on the second division of the subject, the discussion of the question of what school garden ought to be, and what they ought to aim at doing, we are met at once with a good deal of diversity of views. There are some who will say that merely growing ornamental plants or flowers is no use, because most of the boys at the village school in this country will have to spend their lives in following the plough, and farmers are notoriously indifferent to gardening, and have little time for it.

"Again, if it is suggested that the staple crop of the village should be cultivated in a superior fashion in the school garden, the objection is put forward that this will teach the boys nothing, because the high manuring and cultivation possible on a small scale cannot be followed in a field. If, to meet this objection, you suggest that a fair-sized field should be hired or borrowed and the local crops grown under ordinary field conditions, it is said the schoolmaster will be less successful in his cultivation than the local ryots, because he is devoid of their experience, and that the failure which he is certain to meet with will bring on him the ridicule of the village.

"Before discussing these alternatives, there are one or two points which might be laid down. The first is that

THE SCHOOLMASTER SHOULD BE VERY CAUTIOUS

about recommending any particular change in ordinary cultivation to the ryot. Apart altogether from the art of growing of plants or animals, farming is a money-making profession, and without long practical experience it is not possible for any amateur, whatever his knowledge of science, or even of practical gardening may be, to say what will pay on a field scale. Yet, inasmuch as in many villages the schoolmaster is the only educated person, the Agricultural Department cannot afford to take no steps to use him for the improvement of the village agriculture. With this intention, we issue our Agricultural Calendar every year, and try to supply every schoolmaster with a copy. This contains practical advice on well-tested improvements, which may be safely recommended to the ryots. I would ask as a special favour of all the members of the Educational Department present to-night that they should see that every school has a copy of this calendar, and that they should use their influence to get the schoolmasters to read it and discuss the subjects dealt in it with people. Each article is signed, and the writer will be very pleased to give any further information regarding any point which is not clear. In fact, one of our main objects in issuing the calendar is to encourage people to write to us on agricultural matters.

" Another error which should be avoided in school garden is the attempt to grow plants whose natural habitat is outside the tropics. If the plants grow at all, they will be sickly, stunted things, and give the children an altogether wrong idea of the nature of the plant in its own home. In a school garden on the West Coast I have seen wheat growing, but it was such a wretched specimen that I did not at first recognise it at all. Such experiments are

WORSE THAN USELESS,

because they confirm the ignorant belief of the people in the superiority of their own crops to those of other countries. This does not mean that the garden should contain nothing new to the village. In many parts of the Presidency at the present time, ground-nuts are now being introduced These might usefully be grown in school-gardens, where the crop is at present unknown, to accustom the people to the sight of the crop. It would, however, be as well if, before introducing any new product of this kind, the schoolmaster would write to myself or the Deputy Director of the Division be useful and how it should be

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are welcomed, and every effort is made to ascertain the best information. Seeds will also be procured when desired and when it is thought that the crop is likely to be worth trying.

"It would be useless to attempt to lay down any rules for the size or nature or detailed management of a school garden. In most cases the school is situated in dry, uncultivated land and unless there is a well within a very short distance, all gardening proper must be limited to the rainy season. The first thing to do is to plant a few ornamental shade trees, and in choosing these it is best to select one of the trees seen growing in the neighbourhood. If water is available fruit may be tried, and here again the Agricultural Department will endeavour to give advice as to the most suitable, if consulted.

"The first requisite of a school garden is that it should be

NEAT AND WELL KEPT

and, if possible, ornamental. For the reasons given above, these habits stand in much need of cultivation at the present time. It would have the further advantage that it would make the school, too often an ugly, unattractive building, an ornament to the village, and an object-lesson to the villagers of what can be done at small cost to make their own homes more ornamental than they are at present. Next, if any of the local crops can be grown, that is to say, if there is enough space, and if water is available when the plants are such as are usually grown with irrigation, some simple experiments in different methods of planting, manuring, watering, and cultivating might be attempted, and seed selection taken up. Hints as to the kinds of experiments recommended by the Agricultural Department will be found in the Agricultural Calendar, and if none of these are suitable, the officers of the Department will be pleased to offer suggestions if they are addressed. I will make one suggestion here which is applicable to any and every place where plants are grown; our experience shows that the weakest point in the practice of the Indian ryot is his

NEGLECT OF SEED SELECTION.

By growing any of the common crops of the village for a number of years and choosing a few of the best plants each year for seed, it is easy to show the children that much better crops can be secured.

"In the case of private schools, where the owner, as is sometimes the case, is a rich landowner of the village, a good piece of land can be secured, and really useful work done. I recently saw a school

of this description where a capital crop of groundnuts had been grown in the school garden in a district where this crop was new, and as the garden was near the road, many of the passers-by must have seen the crop. It is necessary that people should see and talk about a new thing for some time before they seriously think of growing it themselves. School gardens can thus do a useful work in showing new kinds of crops to the people. On the Coimbatore Agricultural College farm we give every student a plot of his own to cultivate himself. In most cases this would probably not be possible in a school garden, but those children who show special interest in the garden might be

GIVEN SMALL PLOTS OF THEIR OWN

and allowed to have the produce for themselves. Much, however, as from the point of view of the Agricultural Department I should like to see every one of the 25,000 schools in this Presidency turned into a sort of experimental farm, nothing would be gained by expecting too much practical result from the actual work done in school gardens. The real value of school gardens to the Agricultural Department will be the influence which they should have on the minds of both the teachers and pupils. We all know that education is not the pouring of information into a receptive vessel, but the process of turning the mind to the light, and placing it in a position where it can teach itself. The great obstacle to agricultural progress lies in the low esteem in which the farmer's profession is held by the educated and wealthy classes.

"I need hardly remind you that compared with the actual cultivator, all of us who belong to the other classes may be regarded as little better than parasites, living on the wealth created by the labours of the ryot. In spite of this, the farmer's profession is not held in such esteem as it should be, considering its utility to the community, and the

SKILL, FORESIGHT, AND PATIENCE REQUIRED

for success in it. The schoolmaster who starts a garden will soon find that to grow plants is not such a simple matter as he supposed. If he is wise, he will seek the advice of the best cultivators. He will soon see that the cultivation of land calls for exercise of a good deal of intelligence, judgment and knowledge of seasons, besides mere hard work. This knowledge cannot fail to increase his respect for the parents of the pupil. On the other hand, veneration for the teacher is still a strong characteristic of Indians. If the children see that

THE TEACHER HIMSELF IS KEENLY INTERESTED

in gardening and agriculture, and is not above working in the garden himself, it will tend to raise their respect for manual labour and for the profession of agriculture, usually thought unworthy of the serious attention of an educated man. It will also help them to see that the work of the school has a direct bearing on their after-life. The schoolmaster himself will find that the garden brings him into closer touch with the people of the village, and it will help him to understand the problems which his pupils will have to face when they leave his school.

" The effect on the minds of the boys, however, of a well-managed garden is by far the strongest argument for encouraging school gardens in every possible way. One of the greatest difficulties which we have to contend against in the Agricultural Department in our efforts to find out something about the agriculture of the country and improve it is the want of power of

ACCURATE OBSERVATION

on the part of our subordinates, and the intense conservatism of the ryot. The forme have, in most cases had an English education, but have never been taught to observe the common objects which they see round them every day of their lives. Many of our present men are comparatively useless, because they have not had the advantage of being trained during their school days to use their eyes and accurately observe what is going on around their homes. A school garden, where the boys were taught to watch their growth of the plants from day to day, and notice the different effects of different methods of cultivation, might be made into a really useful instrument for training the faculties of observation.

" For the improvement of Indian Agriculture, however, it is not sufficient to have good officials. We also need an improvement in our raw material, the ryot himself. I want all you students of this College to keep this fact always before you minds when you are training Elementary school teachers, and inspecting the schools. We want you to give us ryots whose

MINDS ARE OPEN TO NEW IDEAS,

and who do not, as the present generation of ryot usually does, condemn a thing off-hand, simply on the ground that they have not seen it before.

"The best way to do this is to influence all the private and public bodies who maintain the schools to have gardens at every school where space is available, and to see that the schoolmaster makes good use of it, bearing in mind the hint contained in the Madras Scheme of Studies that 'the instruction fails if it does not arouse in the child a lively interest in his surroundings.'"

—The Agricultural Journal of India, July, 1910.

Some Secondary Actions of Manures upon Soils in England.

1. The long-continued use of sulphate of ammonia on soils poor in lime results in the soil becoming acid.

2. The acidity is caused by certain micro-fungi in the soil which split up the sulphate of ammonia in order to obtain the ammonia and thereby set free sulphuric acid.

3. The infertility of such soils is due to the way all the regular bacterial changes in the soil are suspended by the acidity; instead fungi permeate the soil and seize upon the manure.

4. The remedy, as may be seen upon the Woburn plots, is the use of sufficient lime to keep the soil neutral.

5. From the Rothamsted soils, carbonate of lime is being washed out at the rate of 800 to 1,000 lbs. per acre per annum, the losses being increased by the use of sulphate of ammonia, but lessened by dung or nitrate of soda.

6. Nitrate of soda, when applied to heavy soils in large quantities, destroys their texture.

7. Some of the nitrate of soda gets converted into carbonate of soda by the action of plants and bacteria, and the carbonate of soda, deflocculating the clay particles, destroys the tilth.

8. The best remedies are the use of soot or superphosphate; the best preventive is the use of a mixture of nitrate of soda and sulphate of ammonia instead of either separately.

9. Soluble potash manures and common salt may also injure the tilth of heavy soils through the production of a little soluble alkali by interaction with carbonate of lime in the soil. The remedy is to supply such manures in the winter or in conjunction with superphosphate.

—A. D. Hall, M. A., F. R. S., in "The Journal of the R. A. S. of England," 1909.

An Industrial Exhibition.

A very successful exhibition of Arts and Crafts was held in St. Andrew's Hall on July 27 under the auspices of the Board of Industrial Training. One hundred and forty-four exhibits were received and special stalls were taken by several prominent firms who, however, did not compete with the artisans. The Exhibition was patronized by His Excellency the Governor and Lady Hodgson. Prizes to the value of $167.50 were given.

In commenting on the display, the Hon. J. W. Park, B.Sc., Chairman of the Board, remarked that it was perfectly clear that the conditions on the price list were not observed, especially with regard to the scale to which the article should be made. He instanced the exhibits of model roofing and concrete moulding It would be necessary to be more explicit in the future when drafting prize-list. Several of the unenumerated exhibits could have been brought into the list. They would have to set down one prize for the best unenumerated exhibit in each trade. That would result in a large number of unenumerated articles in one class. Further, many exhibits were sent in at the last moment, and the judges had still a good deal to learn in the matter of awarding prizes. It did not follow that because an article was exhibi ed it deserved a special prize: such prizes should be awarded for merit The thing he was most disappointed at was the absence of competition. It was only when they got a number of examples that the men would be able to see the weak points of their own work. He thought they need do a great deal to encourage competition.

What Prejudice will Do.

A still more remarkable case is furnished by the history of the West Indian vegetable the chocho (*Sechium edule*) in Ceylon. Introduced many years ago by the Botanic Gardens, this most useful vegetable spread widely in the villages, and was much appreciated. A few years later, a rumour was started among the natives (probably owing to some coincidence of serious illness with the fact that the patient was a great consumer of chocho that chochos produced rheumatism. That was sufficient, and the cultivation of this vegetable is now extinct.

—" Agriculture in the Tropics," by J.C. Willis, M.A,, Sc. D.

Rice Experiments, 1910.

The rice experiments with the varieties selected as being the more promising were continued this year and the fields were reaped early in October.

The mean results with the varieties were as shown in the following :—

Varieties.	*Yields.* *Bags of 120 lbs. of Paddy per acre.*	*Per cent. on that of the Creole.*
No 4	32.4	85.9
Creole	37.7	100 0
Suthrà dhán (No. 75)	41.1	109.0
No. 6	42.1	111.7
No. 3	44.2	117.2

The mean increased yields in these cases lie beyond the range of probable experimental error characterising the experiments with rice, and hence may be considered as reliable indications of the relative yielding power of the varieties during the crop of 1910.

The mean results of the Creole and of the varieties which have given higher yields than during the six years 1905 to 1910, both inclusive, are as follows :—

Varieties	*Yields.* *Bags of 120 lbs. of Paddy per acre.*	*Per cent. on that of the Creole.*
Creole	35.8	100.0
Suthrà dhán (No. 75)	37.1	103.6
No. 6	38.0	106.1
No. 3	39 3	107.8

During this period the yields of the Creole variety have ranked second in two crops, third in one crop and fourth in three crops. Suthrà dhán has given the heaviest yield in one crop, and has ranked second in three crops and third and fourth each in one crop. No. 6 was also first in yield in one crop, ranked second in two crops, third in two crops and fourth in one crop No. 3 produced the highest yield in four crops, and has ranked third in one crop and fourth in another.

Messrs. Wieting & Richter are very kindly about to make for us comparative milling tests of the rices of this year's crop.

The manurial experiments with the rices promised to be of considerable interest, but the land has again proved too rich to give really reliable results—results beyond the range of probable cultural errors—as to the value of the various manures applied. There were, however, strong indications that as the land gets somewhat poorer manurings with nitrogenous materials will prove advantageous.

J. B. H.

F. A. S.

October 15th, 1910.

The Quality of Different Rubbers.

The quality of plantation rubber is, of course, largely dependent on the method employed in its preparation. I may here call attention to a recent paper read before the Society of Chemical Industry by Mr. Beadle and myself on 3rd May last. The result of tests detailed in that paper on rubber vulcanised with heat in the usual manner showed that the samples of Ceylon plantation rubber were slightly—yet distinctly—inferior in physical qualities to the sample of hard cured Para. Another series of tests on manufacturers' samples of cold cured goods made from hard cured and the best plantation were in favour of the plantation samples. Another important point was brought out in this work, namely, that a difference in the age of the trees, say from five to twenty years old, appeared to have little or no effect on the physical qualities of the vulcanised rubbers. I was glad to notice that Mr. Parkin. . . .had come to the same conclusion on purely botanical grounds, and wrote that he would be rather surprised to find any marked difference in the quality of the rubber drawn from ten-year-old trees as compared with twenty-year-old ones, as in both cases the latex is formed from secondary growth and is not comparable with that derived from laticiferous vessels of primary growth in the twigs and leaves.

—Mr. H. P. Stevens, M. A., F. I. C., quoted in "The Tropical Agriculturist," March, 1910.

The Souari or Butter-Nut Tree.

The Souari or Butter Nut (*Caryocar nuciferum*) is the product of one of our largest forest trees. This tree often attains a height of 100 feet and is generally recognised as one of the giants of our forests. The diameter of the trunk when full grown is between three and four feet and the spread of branches and leaves is very great. The flowers are large and of a deep purplish-brown colour. The fruit generally contains from 2 to 4 nuts, which have a reddish brown hard shell. The kernels of the seeds are white and of a very agreeable flavour, being considered by many far superior to the well-known Brazil nut.

The Souari is to be found principally in light soils, of a sandy-loam character. It is seldom found in swampy land, and appears to keep to the slopes of the hills and higher levels.

As so very few of our large forest trees are to be found growing on the coastal lands of the colony, much interest attaches to the attempts, that have been made to establish them in localities which may be described as outside of their natural habitat. The acclimatization of the Souari nut on the lands at Onderneeming is of interest.

Some young seedlings of the Souari were sent to Onderneeming by the Director of Science and Agriculture in 1905 together with instructions with regard to planting them, and as the experiment has been successful the details of their growth and treatment deserve to be placed on record. The first two seedlings were planted out in August, 1905, in contiguous positions, the spot being sheltered from the full force of the wind, while the soil was a sandy loam with depth of drainage of about three feet. One of these plants had got damaged in transit to Onderneeming and died within a few months of being put out, the other however immediately began to make vigorous growth. It received ordinary care in the shape of periodical weedings and was always kept heavily mulched. Twice annually also during the first two years of its life it received light forkings and a copious supply of pen manure. At no stage did it appear to require pruning. In July, 1909, or when the tree was still under four years of age, blossoms first made their appearance and in October it was noticed that fruit was forming. The fruit appears to take a long time to mature as it was not until six months later, March, 1910, that ripe fruit began to fall. The tree,

which is now exactly five years old, is 32 ft. high, the diameter of its spread being 20 feet. The girth measurement of the trunk is 21 inches at the bottom and 17 inches three feet from the ground. The lowest branches are three and a half feet from the ground, being symmetrically placed one on either side of the trunk. A small crop of fruits (only 31) has been obtained, although the average yield of a fully grown forest tree is stated to be about three barrels. The large majority of fruit from this tree contained only one nut each, and only five pods contained two nuts. It has, however, to be remembered that this is only the initial effort of a very young plant, and it is interesting as the early age at which it has fruited is at striking variance with generally accepted ideas of the great length of time this tree takes to reach the bearing stage. I have heard it computed at 21 years, while the tree growing in the Botanic Gardens, Trinidad, took fourteen years before it bore fruit. I am informed by an intelligent wood-cutter and grantholder in the Essequibo River who has lived in the vicinity of these trees for nearly a score of years, and traded in the nuts, that the trees fruit regularly every year.

The ground around Souari nut trees is said to be generally infested with snakes. Deer, Bush Hog, and other animals feed on the skin or outer shell of the pods as soon as they fall from the trees. This skin is soft and mealy at first but dries hard and flaky. The nuts, or seeds of the pods are however by reason of the extreme hardness of their shells rendered secure from animal or bird life with the exception of a small squirrel, that—so it is said —succeeds in gnawing through after much trouble.

The Acouri collects the nuts and stores them, but seems to fail to get through their hard shells, as bunches of young plants are sometimes discovered growing in nests evidently where the Acouries have originally stored and eventually abandoned them. The Indians use the shells of nuts as fuel and also medicinally; for after they have been thoroughly charred and burnt they are powdered and mixed with water, and the draught is taken for bowel complaints.

Although the tree is described as yielding a durable timber used in shipbuilding, I am not aware if much or anything is done in this direction in this colony. That the Indians regard the tree as valuable is borne out by the fact that while they use the large roots in making crooks for building boats and canoes they appear to be careful in digging and cutting them out to divide their attentions

among different trees so that the damage to any one may not be considerable.

Of the other Souari trees at Onderneeming one planted in February, 1906, blossomed towards the end of last year but no fruit formed It is however, now flowering again, and if any fruit are obtained on this occasion the bearing age will entirely agree with the first mentioned tree Both plants were put in under similar conditions and received the same treatment, the rate of growth made being slightly in favour of the older tree, the measurements of the younger one showing:—Height, 28 feet; spread of branches, 14 feet; girth of trunk at bottom, 20 inches and girth of trunk, 3 feet from ground, 15 inches. Another tree planted in May, 1909, is also doing well, having already reached a height of 12 feet.

That the Souari nut tree has grown so readily at Onderneeming leads one to conclude that it may be cultivated with equal ease on a large number of other coastal and river estates, and if the yield were at the rate of three barrels of nuts per tree at five dollars per barrel the present market rate in Georgetown) it should prove an extremely remunerative cultivation.

It would possibly take 19 or 20 years for the trees to reach full bearing, but one barrel of nuts per tree might reasonably be expected in 10 years. The trees should be planted at least 40 feet apart, and other crops could be grown in between them for the first three or four years.

S. H. BAYLEY.

Onderneeming,
17th August, 1910.

The Yield of Sugar-Cane.

The general results show that with all the varieties (of sugarcane) under trial, nitrogen in a readily available form is the manurial constituent that governs their yields. On the less fertile of the two fields, the very heavy dressing of 90lbs. of nitrogen per acre (450 lbs. of sulphate of ammonia) resulted in marked and profitable increases; but on the more fertile field, on the average, very little increase was occasioned by increasing the nitrogenous dressings above 60 lbs. of nitrogen per acre. . .Nitrate of soda has not been as satisfactory as a source of nitrogen as sulphate of ammonia.

—"Progress Report," 1910: Dept. of Sc. & Agric., B. Guiana.

Agricultural Shows.

Two Agricultural Shows call for a brief notice, as they were held during the quarter. One was the Fourth Victoria-Belfield Show, held in Sendall Park, Victoria, on August 9th, and the other the Seventh Annual Show on the West Bank, held on August 17th, at La Grange Old Overseers' House, Canal No 1, West Bank, Demerara. Both were opened by His Excellency the Governor in person, accompanied by the Director of Science and Agriculture and the Assistant Director.

Of the first, Mr. Waby reports :—

"As a whole the Exhibition was much the same as that of two years ago, neither better nor worse, and the exhibits occupied a similar space as at that time. It cannot be said that there was any improvement either in the exhibits themselves or in the manner of exibiting them, the same lines being carried out in each case ; neither was there any difference in the receptacles used for exhibiting the various articles, all sorts and conditions of boxes, baskets, etc.,—anything that would hold something—was there with no idea of making the exhibits as good-looking as possible. The stages were all too low, either for exhibiting the articles to the best advantage or for comfort in viewing them."

On the second he reports thus :—

"The first view as a whole gave the idea of a very fine display all through, and there seemed to be a great improvement on the previous year ; the improvement was, however, more apparent than real, for except that there was a larger quantity of fruit, the quality of most things was very similar, so that it may be said the Show was very much the same as that of last year, it still holding its own as better than the other District Shows. It was decidedly much in advance of the Show of the previous week at Victoria, but as Victoria-Belfield had made no improvement whatever on its Show of two years previously it is doubtful if the West Bank can claim much advance on its own of the year before : still it had not fallen off and can claim first rank. Before last year Buxton led the way, but last year had to take second place to the West Bank, Buxton still keeping ahead of Belfield."

It may be added that the whole subject of these Agricultural Shows is receiving the attention of the Board, and important developments may be expected shortly.

An Effective Insecticide.

I have commented, on several occasions, upon the difficulty of obtaining reliable insecticides locally, or at a price that will permit of their extended use. The following circular letter from the Indian Imperial Entomologist describes a useful insecticide manufactured in India and found to be a reliable contact poison. Particular of prices can be obtained from the 'Vermisapon Specialities Co., Coimbatore,'

Dear Sir,—Insecticides are being increasingly used in India, and I have for several years been trying to render available to the public good insecticides at a reasonable price. Up to now, there have been no firms or private individuals specialising in this, and the insecticides principally used have been those made locally as required. I have at different times tested patent insecticides which firms in England, America and Germany proposed to sell in India, but these have been practically all either inefficient or too costly. Recently an insecticide made in India, known as Vermisapon, has been put on the market; the producers have consulted me, and I have suggested certain modifications. The insecticide has been thoroughly tested by me on a variety of insects, and I know how it is prepared. It is, I believe, a thoroughly reliable contact poison, effective against the various sucking insect such as bug, meal bug, scale insects and plant lice, thrips, etc., which attack tea, coffee, fruit trees, vegetables and garden plants ; will also kill small caterpillars and biting insects, and to some extent destroy large biting insects, but it is not a stomach poison. It is harmless and non-poisonous, requiring no heat for its mixing with water, and prepared by simply dissolving in water. Its price is remarkably low, and it is the cheapest insecticide known to me, even Rosin Compound. I write to draw your attention to it, as it is likely to be of value in many cases where spraying is or should be practised, and because its production in India removes one of the difficulties which formerly militated against spraying as a remedy for pests on valuable cultivations. —Yours faithfully,

—(Signed) H. M. Lefroy, Imperial Entomologist."

E. E. Green (Gov. Entomologist) in Tropical Agriculturist (Ceylon), July, 1910.

Visits to Country Districts.

CHRISTIANBURG.

The Director, Assistant Director, Agricultural Superintendent, and Head Gardener visited the Experiment Station at Christianburg and went through the whole of the rubber cultivation and the experiments with forest trees. The Para rubbers (*Hevea brasiliensis*) are growing more satisfactorily than are the local species, and in some situations the Para rubber trees are looking decidedly promising. A few Sapiums were planted a little over two years ago on some 'Mora reef' soil along the river bank. These have grown exceptionally well and are quite healthy and vigorous.

POTARO.

The Assistant Director and the Head Gardener then proceeded through to the Potaro and went up to the Minnehaha Dredging Concession. A species of Hevea with reddish under-surfaces to the leaves was observed to be fairly common along the sides of the Potaro road. This species appears to differ from the other kinds that are prevalent in other districts of the colony. A few small samples of coagulated latex were obtained, and other samples have recently been seen that have been collected from this district. The product appears to be resinous and weak.

BONASIKA.

Visits have also been made in connexion with the tapping experiments at the Bonasika reserve. The Sapium trees have been divided into groups, and the latex obtained is being coagulated separately. Morning and evening tappings are also being compared. The front of the reserve has again been lopped down and some Para is to be planted in order that the growth of this rubber-producing tree may be observed in this part of the colony.

BERBICE.

The Assistant Director has visited New Amsterdam to inspect the work of the agricultural instructor stationed in the county of Berbice, and arrangements are being made for the raising of lime seedlings at Stanleytown Model Garden to supply cultivators in that county.

EAST COAST.

A visit has also been paid at the instance of Mr. Quelch to Plantation La Bonne Intention in connexion with the occurrence of *Castnia licus* in the canes of that plantation. This pest is widely distributed throughout the sugar-estates of the colony and will have to be fought consistently. Mr. Quelch has worked out the life history of the pest and the majority of estates are adopting the remedial measures advocated. The prevalence of this pest in the canes and plantains of the villages will shortly be investigated. The judging of the cane plots entered in the farmers' competition is being undertaken, and as soon as the canes have been cut the plots will be examined further.

WEST BANK, DEMERARA.

Tapping of Para rubber at Pln. Noitgedacht has been inspected by the Assistant Director and the Agricultural Superintendent. The trees appear to be giving satisfactory returns and the 8lb consignment of rubber that has been shipped to England appeared to be of satisfactory quality, although somewhat damp. Tapping is being done in the early morning and coagulation is being effected by acetic acid in soup plates, the rubber being smoked when it is partially dry. The largest tree, with a girth of 40½ inches at 3 feet from the ground, is giving a very good flow of latex.

The Director and the Agricultural Superintendent accompanied the Hon. the Colonial Civil Engineer and Mr. Harvey went up the Demerara river as far as Malali and inspected Christianburg on their way up the river.

F. A. S.

America and Root Crops.

The domestication of root crops characterised an early epoch in the development of primitive agriculture in tropical America. This is shown by the large series of roots crops that were domesticated in America. In addition to the cultivated aroids, there were sweet potatoes (*Ipomœa*), arrowroot (*Maranta*), cassava (*Manihot*) yams (*Dioscorea alata*), apio (*Arracacia*), Ileren (*Calathœa*), potatoes (*Solanum tuberosum, S. commersoni,* and o her Species ullucus (*Ullucus tuberosus*), tous-les-mois (*Canna edulis*), masua (*Tropœolum tuberosum*), oca (*Oxalis crenater*), and the Jerusalem artichoke (*Helianthus tuberosus*). The yam bean or icama (*Pachyrizus*) and the chayote (*Chayota* or *Sechium*) were also grown as root crops, though propagated from seeds.

—Trop. Agriculturist (Ceylon), June, 1910.

Hints, Scientific and Practical.

The Action of Cold on Plants. The action of cold on plants varies not only with the nature of the plants themselves, but also in accordance with certain little understood changes which take place in their cell-contents. The theory which has in the past been accepted as explaining the death of plants from cold was based on the rupture of the cell through expansion and contraction due to changes in temperature. When the tissues of higher plants are frozen, films of pure ice form on the walls abutting on intercellular spaces, and these films grow steadily to quite large lumps of ice, causing disruption of the tissues. Miller-Thurgan and Molisch held that the fatal effect of freezing was to be traced to the resulting dessication of the protoplasm whereby its structure was irrecoverably disorganised. It was thought that it was only on the thawing of the cell that the fatal disorganisation set in, and that if the thawing proceeded very slowly recovery might take place, although if the change of temperature were sudden and the thawing rapid, recovery would be impossible. Experiments, however, demonstrated the incorrectness of this view, and investigations by Lidforss, a Swedish botanist, have suggested an explanation which appears to account for certain phenomena which were previously inexplicable, e.g., the effects of late spring frosts in comparison with more severe frosts earlier in the season, and the reason for the beneficial effect of " hardening off " plants raised under glass.

The investigations were made on the plants which remain green through the winter in South Sweden, and established one general characteristic of all these plants which appears to protect them from the effects of frost. This is that all winter-green leaves are quite free from starch, but contain quantities of sugar and sometimes of oil in the mesophyll. In the summer these same leaves contain starch, which is in the spring regenerated from the sugar.

The presence of this sugar in the cells has been shown to enable the plants to survive a lower temperature, and according to Lidforss, the conversion of sugar into starch explains why it is that a plant which has survived the profound and prolonged cold of winter may be killed by a sharp night frost in early spring, especially when the night frost is preceded by a spell of bright sunny radiation. A succession of warm days in spring causes the disappearance of the pro-

tective sugar and the regeneration of starch in the plant, and it is this that makes the plant susceptible to cold. This theory is borne out by the observation that it is the well-sunned south side of evergreen trees like Ilex and Taxus that suffer in such weather, and that here the sugar has gone, while the shaded north side of the tree still keeps its sugar and is uninjured by the spring frost.

—Editorial Notes in "Journal of the Board of Agriculture" (England), July, 1910.

Tape-worms. The Tapeworms are a group of flat-worms which are entirely parasitic in habits. They are segmented, but not in the same sense as we understand the segmentation of the true Annelids. There is neither a mouth nor an alimentary canal, as the nutriment is taken in by the process of osmosis, absorption being effected through the skin of the whole body-surface. These cestode worms, with a few notable exceptions (*Bothriocephalus*), undergo a curious alternation of generations. The two stages in the cestode life-cycle have often been d scribed under two different names. The stages are—(1) the adult worm, which is always found living in the intestines of man and various animals and birds, &c.; and (2) the "cystic stage," which is usually found in a totally different host, and in some of the organs or connective tissues of the body, not in the intestines. The diseases produced by tapeworms are known as *tæniosis*, and in some cases the disease ends fatally not only in animals but also in man. A well-known instance of this vermiceous group is the disease called "measles in pork," which is produced by the cystic stage of a tapeworm (*Tænia solium*) that invades man. The worm is contracted by eating infested pork insufficiently cooked.

—A. F. V. Theobald, M.A., F.E.S. in "Agricultural Zoology."

Spraying. Farmers and fruit-growers cannot fence out the many forms of insects and fungi which live upon their crops and which are as anxious for a harvest as the grower is. It is a fight between the grower and the pest, and it must be admitted that the latter has generally had the best of the battle. The farmer has not been properly equipped. He has often had invisible foes to contend with,—foes which he did not understand, and which he could not assail. It frequently occurred that an entire crop was ruined in a day or two

and the cause remained unseen and unknown ; and even if it was visible, almost the only remedy upon which the grower could rely with certainty was mere force, first catching the pest and then destroying it. As this could be done with profit only in rare cases, it was little better than no remedy, and the general result was that the insect or the fungus obtained an ample supply of nourishment, and the grower took what was left. Indeed, this method is still followed by many cultivators, but it is not the safest, nor is it the most profitable one.

The best is generally the most profitable commodity, and the poorest is the least so ; and the grower of to-day has it in his power to produce the best. It rests entirely with him whether his apples shall be wormy or not, whether his trees shall retain their foliage or lose it from disease. There are few evils that affect the crops which he cannot control, in many cases almost absolutely. Only a few diseases remain which still refuse to submit to treatment, but the number is rapidly decreasing, and the time will come when these also will disclose some vulnerable points which will allow of their destruction.

Foremost among the operations by means of which cultivated plants are protected from their enemies, is spraying. This consists in throwing upon plants any fluids, or semi-fluids, in the form of a fine rain or mist. It rests upon the general principle of covering the plants, or the parts of plants to be protected, with a thin but uniform layer of some material that is poisonous, caustic, or offensive to the organism which it is desired to destroy.

—E. G. Lodeman in " The Spraying of Plants."

The Theory of Farmyard Manure. The changes going on during the making and storage of farmyard manure are . . , exceedingly complex ; it is in the early stages that the bacterial actions are most rapid, and they fall chiefly upon the soluble nitrogenous compounds like urea. At this time the greatest losses of nitrogen take place both by volatilisation of ammonia and by evolution of nitrogen gas, and so active is the oxidation that the temperature of the mass rises continually. If the rate of oxidation be promoted by occasionally turning over the mass, as in preparing a hot-bed or a mushroom heap, the rise in temperature is much increased ; at the same time the losses of nitrogen rise rapidly, and the amide and ammonium carbonate disappear more quickly. What the gardener calls " taking the fire " out of the manure means so reducing the free ammonia that

the material is no longer injurious to a plant's roots, though it still remains rich in nitrogen and organic matter capable of further decay. As soon as the first violent reactions are over, especially after the mass has become consolidated by trampling and the oxygen in the entangled air has been used up, the rate of change slows down considerably; it now consists mainly in the attack of the anaërobic organisms upon the carbohydrate material. The long strawy dung begins to change to "short" or rotten manure, and this change may continue slowly for years, until all trace of structure is entirely gone and only a brown pulp is left. During this second change but little loss is experienced by the nitrogenous compounds; if the mass is kept tightly pressed and moist enough to exclude air, there will be no loss of fertilising constituents, only a gradual decline of weight as some of the carbon compounds are converted into gases. Of course, as the manure gets older and shorter it becomes richer in nitrogen; this apparent increase is, however, simply due to the loss of non-nitrogenous carbon compounds, whence it follows that the nitrogen, which does not waste, always bulks larger and larger in the residue. But though there is no loss in nitrogen in these later stages, the more active compounds, such as ammonia and the easily decomposable amides, become converted by bacterial action into carbon compounds which take longer to reach the plant when the manure finally gets in the soil. Thus, during the making and storage of farmyard manure there are a large variety of bacterial actions at work, some running in an opposite sense to others, and it will depend on such external conditions as the supply of air and water which class of action predominates at any given time, Putrefactive bacteria are resolving proteins into simpler compounds of nitrogen and ultimately into ammonia; oxidising bacteria (sometimes called denitrifying bacteria) set free nitrogen gas; meantime the bacteria engaged in the destruction of cellulose and the formation of humus are always building proteins or bodies akin to them out of the previously produced amides and ammonia.

Another change sometimes takes place when the manure is allowed to get too loose and dry—instead of bacteria, fungi begin to develop very rapidly until the whole mass becomes permeated with the mycelium. The masses of manure begin to look white and dusty, a condition which the practical man describes as "fire fanged." It is generally agreed that such manure is seriously deteriorated, but no analyses are available.

—A. D. Hall, M.A., F.R.S., in "Fertilizers and Manure."

The Fertilizing Effect of Partial Sterilization of Soil.

It has been known for a long time that if a soil be heated or treated with antiseptics so as to partially sterilise it, its productiveness is commonly increased. The cause or causes of this effect have been obscure, and a recent contribution by Messrs. Russell and Hutchinson, of the Rothamsted Experiment Station, on this subject, is exceedingly valuable, since it throws a good deal of light on the problem.

Briefly stated, if a soil be heated to 98° C. (208° F.), the succeeding crop will be two, three, or even fourfold of what it would otherwise have been. The cause of this increased fertility has been attributed successively to chemical, to physiological, and to biological changes; and it has been the object of the Rothamsted work to provide a more correct explanation than that which has hitherto been offered. The first section of the new work showed that, whatever the actual cause, the effects of heating the soil to 95° C., or treating it with an antiseptic, such as toluene, were: (i) a much more rapid production of ammonia from the organic matter of the soil; (ii) cessation of nitrification; (iii) no marked change in the amount of humus in the soil; (iv) the production of unstable nitrogenous compounds was accelerated. It was also proved that an ordinary, that is, unsterilized, soil contained some factor which limits the development of bacteria, which factor is put out of action by partial sterilization. Further investigation showed that the larger organisms, such as infusoria, amæbæ and ciliata, which are present in untreated soil, were practically absent from the same soil after partial sterilization.

These larger organisms are known to devour bacteria and consequently limit bacterial activity in a soil.

The explanation which Messrs. Russell and Hutchinson offer for the increased fertility of a partially sterilized soil is this:—soils contain a wide variety of organisms, which may be divided roughly into (*a*) saprophytes, which effect the decomposition of organic matter; and (*b*) phagocytes, and other organisms which consume living bacteria, or are in other ways inimical to them.

When a soil is partially sterilized by toluene or heat, the phagocytes are killed, but bacterial spores survive. On removing the toluene and adding water these spores germinate and the resulting organisms multiply with great rapidity, resulting in a largely increased production of ammonia. At the same time it was ascertained that some organisms suffer seriously, especially those

which fix atmospheric nitrogen, and the nitrifying organisms are entirely destroyed. Thus, the nett result of partially sterilizing the soil in the manner described, is to increase the ammonia, but to inhibit nitrogen fixation and nitrification. The plant which is subsequently grown in such sterilized soil then apparently depends on ammonia as its source of nitrogen..

—J. W Leather, Ph.D., F.I.C., F C.S., in "The Agricultural Journal of India," July, 1910.

To Judge the Age of a Fowl.

In the case of a pullet, the surface under the wings will always be found interspersed with minute rose-coloured veins, which are totally absent in birds that are more than twelve months old. Again, there will be found, with pullets, a fair supply of long, silky hairs, which disappear directly the first moult is concluded. In the adult hen, the skin will be found to be perfectly white, and free from either veins or hairs; hence it is easy, at a single glance, to estimate correctly whether a bird is under or over the age that acts as a line of demarcation between juvenile and adult stock. Additional evidence is forthcoming in the formation of the pelvic bones which, in a pullet, are much closer than in the hen that has passed the pullet age. At two years they are much wider than at one year, so that birds at this age can be readily distinguished from those of, say, fifteen and eighteen months. The third point of difference is observable in the shanks and claws. In the young bird, the skin of the claw is supple, and the scales are thin and brilliant. The skin gets coarser and stronger and the scales harder, as the bird grows, and the nail of the first toe, which does most of the work, gets much worn. There is also a difference in the eyelids. These acquire wrinkles as the bird gets older, and there is also a slightly shrivelled look on the face. This with age becomes more and more pronounced. Lastly, there is the question of wing feathers—the most infallible test of all. At the conclusion of the first complete moult, which takes place when the fowl is exactly twelve months old, the secondaries alter in shape, and bear indisputable evidence as to the dividing line having been crossed. Although the surest test of all, this latter can only be ascertained by those well versed in handling feathered stock. —Quoted from "The Farmer and Grazier" by "The Agricultural News," Barbados, May 14, 1910.

Board of Agriculture.

Visit to the Botanic Gardens.

On Monday, September 26th, the Board of Agriculture paid an official visit to the Botanic Gardens and the Experimental Fields, there being present the Director of Science and Agriculture, the Assistant Director, the Hon. J. W. Park, Rev. F. C. Glasgow, Messrs. J. Wood Davis, F. R., T. E. Earle, J. Gillespie, J. Junor, and J. Monkhouse with Mr. R. Ward (Agricultural Superintendent), and Mr. O. Weber (Secretary of the Board). Accompanying the party were Mr. A. F. C. Curiel, of Surinam, and Mr. J. R. C. Gongryp (Government Agricultural Inspector, Surinam).

The nursery beds attracted no little attention, the rubber—from four to five years old—of different kinds and growing under "nursery" conditions being of considerable interest in present circumstances. In the Herbarium, the new botanical laboratory was seen and a move was then made to the rice fields, covering ten acres, where an illustration of the success of ammonia sulphate as a manure was pointed out. The fruit border, next visited, was in fine condition, the trees repaying well the care spent upon them and being remarkably free from insect pests. In the cane beds, D625 was much admired, and seedlings 145, 4,397 and 2,468 were favourably commented on. The absence of borers was noted. Amongst other items of note were the Hevea cuttings and some sisal hemp plants which promised a length of four feet of fibre. The visit was concluded with the usual hospitalities.

Waterproof Canvas.

To waterproof canvas, the following is recommended :—Into 1 gallon of rain water stir 1 oz. of sugar of lead and 1 oz. of powdered alum until they are quite dissolved. Let the solution stand till the sediment falls. Then pour off the water and lay the sheet in it for twenty-four hours. This liquid will also render ordinary cloth rainproof. If an oil sheet is no longer waterproof, give it a good coating of a dubbing made by melting 1 part of mutton suet and 2 parts of beeswax. When these are thoroughly mixed, apply with a piece of rag.—Queensland Agric. Journal, July, 1910.

Agricultural Instructors' Reports.

The following summaries of the reports of the agricultural instructors stationed in country districts are of interest. They indicate the chief points brought before the Director of Science and Agriculture by the agricultural instructors and should be read particularly by those farmers and grantholders who have recently received visits from these members of the Department :—

BERBICE.

From the brief reports received from Mr. Mansfield, it is gathered that considerable interest is being taken in planting rubber and limes on some of the larger properties while efforts are being made to interest the smaller cultivators in lime cultivation.

Rubber—This crop is making headway in many situations. Both Para and Sapium are growing vigorously, and are quite healthy. On well drained lands up the Canje Creek rubber looks exceedingly promising, and planting is now being undertaken on other river and creek lands. At Canefield, the old Para rubber trees have again seeded this year, and a promising lot of young seedlings has been obtained.

Limes are making fair progress at Pln. Providence and scale insects have been brought under control. There are large areas of good sandy loam well suited to the cultivation of limes in the Berbice district, and an interest in this crop is being awakened. Plans have been made to commence the raising of lime seedlings at the Stanleytown Model Garden, and it is hoped that the pupils will take a lively interest in this experiment.

Coconuts.—The coconuts in New Amsterdam have been badly attacked by caterpillars, but very few efforts have been made to cut down the 'nests.' This pest is easily controlled provided that it is watched. On the sandy reefs in Berbice large numbers of coconuts could be planted. Instruction has been given in many instances in the planting of this crop, with a view to getting the plants put in at proper distances and to providing proper drainage. Some 'bud-rot' disease has been reported from a few properties.

Cacao is generally in need of thorough pruning and disease is no uncommon. Specimens of witch-broom have been sent down for examination, while black-pod disease is prevalent on many properties. With more attention to careful cultivation and the treatment of diseases the cacao in Berbice ought to rapidly improve.

The drainage in many cases is defective. It is of the greatest importance in cacao cultivation to have good deep drainage.

Plantains.—Many plantains have been affected by disease and an investigation of the matter is being undertaken. Improvement of drainage in many plantain cultivations is needed.

Rice.—Considerable areas under this cereal have been visited and instructions given to the growers. An effort is being made to get growers to recognise that early planted rice on the average yields better than late planted rice, that the cultivation of the nursery must be thorough, and that adequate drainage should be provided if success is hoped for. Some promising fields of rice have been visited.

POMEROON.

Mr. Abraham in his three monthly reports, gives the following information in connexion with economic products on the grants in the Pomeroon that he has recently visited :—

Coffee :—Liberian coffee is generally healthy, but in some cases was found to be in want of pruning. Very few grantholders top their trees, but an effort is being made to get some of them to try the experiment of topping Liberian coffee to a height of 6 or 7 feet. Some trees have been observed with yellowish leaves, but on investigation it was concluded that this yellowness was due to mal-nutrition, and not to disease. Scale insects have been noticed in some instances but they are not very frequent.

Arabian (or creole) coffee is not largely cultivated, but that which was visited was in a fairly healthy conditlon.

Robusta coffee is now being tried by a few grantholders, the plants having been obtained through the Market Stall at Marlborough.

Cacao.—A few fair plots of cacao have been visited, but the greater number are not in a satisfactory condition. In some instances, the drainage is very imperfect and consequently the plants are far from thrifty. Diseases are common in some of the plots, while too close planting and bad pruning are not infrequent. Cacao to be successful must be very carefully cultivated, and the drainage must be in good order. Considerable improvement is being looked for in the cultivation of cacao in the Pomeroon. Better drainage, attention to distances of planting, to pruning and to better cultivation seem to be required.

Coconuts.—These trees do well when the drainage is properly attended to. Drainage is being given closer attention now as it is being realized that a large number of the plants that have died could have been saved had the drainage been more effective. Coconuts in the Pomeroon suffer from bad drainage, and this is a point that cannot be given too close attention by the cultivators. The distance of planting is another point that has to receive attention. Too much close planting has been done in the past, but now distances of 25 feet x 25 feet, 30 feet x 30 feet and even 36 feet x 36 feet are common in the youngest cultivations.

Rice—On the grants visited, very little rice was being cultivated. The results in the past year had not been as satisfactory as had been hoped, and therefore at present attention was being given to the cultivation of provisions and other crops. One grant visited had a very fair plot of rice, but the drainage could have been improved.

Rubber—Both Para rubber (*Hevea brasiliensis*) and *Sapium Jenmani* are being planted on some grants. The growth so far is exceedingly good, the sapiums averaging a mean girth of 22 inches at 1 foot from the ground at three years of age and the Para rubbers giving a mean girth of 15 inches at 2½ years old. Both kinds are quite healthy and they appear to be very promising. The sapiums were generally found to be in need of pruning, and demonstrations in this important operation in the cultivation of this rubber plant were given. The Heveas have not yet been topped, but this is now being practised on some plants.

Provisions.—Ground provisions were on the whole healthy, and some very good crops have been visited. Plantains were found tobe healthy, except in the case of one grant which had been planted with diseased suckers. The attention of grantholders has been drawn to the danger of this practice, and the holes which were showing marked signs of disease have been dug out. Corn in one grant has suffered severely from attacks of the corn stalk borer and the yield has been poor. On another grant a very good crop of corn has been grown, and pumpkins have been grown between the rows of corn.

NORTH WESTERN DISTRICT.

Mr. Matthews reports that spraying of Sapiums for scale insects has been commenced at the Issororo Experiment Station. Very few trees are affected on the Station, but on some of the grants scale insects are common. Some of the trees that were affected

on the Station had been pruned severely and the increased growth afterwards had not up to the time of report been affected by scales. The planting of Para rubber was being pushed on, several different methods being adopted. The hill slopes were now subjected to monthly 'brushing' to keep down the bush and at the same time encourage a grass turf. By keeping down the bush systematically better growth of the rubber plants has resulted, and by encouraging a turf it is hoped that the 'wash' on these hill slopes will be prevented.

The new extension is being pushed on, and should shortly be ready for planting up, the plants having been safely received from the Botanic Gardens, Georgetown.

Experiments are being carried out with imported varieties of corn, but so far these varieties have not compared favourably with the local varieties.

As soon as the work of the new extension at the Station is well in hand, visits will be paid to the different grants in the district in order to ascertain what progress has been made since the visits which were paid earlier in the year.

F. A. S.

Coal Ashes for Tomatos.

Years ago, in cleaning up a large accumulation of coal ashes, I had them carted and spread on a grazing paddock, arguing that they would probably do no harm if no good. The growth of white clover as far as those ashes went was something wonderful, as compared with the land around. It was a compact and moist clay soil, and I suppose the absorption of moisture favoured the clover. On another occasion I had a pile of coal-ashes in an out-of-the-way place had been left there for more than a year. In the spring by some means, a tomato seed got there, and a plant grew on top of that ash heap over 3 ft. high. It was left alone, and no attention paid to it. But that tomato plant with only 3 ft. of coal ashes under it gave me more tomatoes than any one plant in my garden. I would like to have an analysis of coal ashes that have been left in the weather for a year or more, for it does seem they have some power of absorbing some plant food. As a mulch under gooseberry and currant bushes, I have found coal ashes very useful.

—Queensland Agric. Journal, June, 1910.

Answers to Correspondents.

J. V. G.—Your application for seed paddy is much too late for this year's distribution. Apply in February of next year as the seed paddy of the Board of Agriculture is distributed about that time. The most satisfactory returns are obtained by planting in March or April.

G. H. A. G.—The fruiting specimens of a latex producing plant locally called 'maboa' are from the plant *Plumiera saccuba*. The value of the rubber-like product has not yet been definitely ascertained.

S. H. B.—The bee moth is not easy to get rid of. It attacks weak hives commonly and its ravages can be prevented by feeding the attacked hives.

G. B. W.—The large leaved plant is very common. It is *Plumiera saccuba*. The other two plants are as follows:—the large fruited one *Tabernaemontana undulata* and the smaller fruited one *Tabernaemontana rupicola*. Another species of *Tabernaemontana*, viz., *utilis* is known as hya-hya.

S. AND G.—The leaves are those of *Sapium aucuparium*—the common 'bird-lime' tree of the coastal regions of the colony.

POMEROON.—The coffee leaves show no signs of specific disease. The yellow appearance may be due to lack of proper drainage. If the drainage is satisfactory, a small application of nitrate of soda to each tree may improve their appearance.

WATER STREET.—Bay berry wax is the same as Myrica wax, and is the product of several plants of the genus *Myrica*. No species of *Myrica* are represented in the Herbarium.

RUBBER.—The knives that appear to us to be the most useful for tapping purposes are the Alpha Safety knife and the Jebong or Improved Farriers' Knife. The Para chisel and a small rounded carpenter's gouge answer well for re-opening cuts—the former on old Sapium trees and the latter on cultivated Para.

J. S.—For methods for the control of acoushie ants you are referred to the *Journal* for April, 1908.

G. R.—The brown rices that you complain of are probably the result of former cross-fertilizations. Seed for planting should be

carefully picked over, and those plots of rice that are being set aside for seed purposes for next year should have all the stools of brown rice removed. The Board of Agriculture is attempting to get absolutely pure strains of rice, so that the quality of British Guiana rice may be maintained.

SUGAR.—The seedling D. 625 is not a Bourbon seedling. It is a seedling of Dyer, a variety raised from the Meligeli—a cane secured for experimental purposes from various parts of the world, and which was also found more or less commonly in some of the fields of Bourbon in Barbados and in this colony.

READY RECKONER: The following extract from the correspondence columns of the Queensland Agricultural Journal may be the best reply to your query :—

" The plants being set out at given distances in feet, all that is needed to find how many plants go to the acre is to divide 23,560 (the number of square feet in an acre) by the distance between the plants in the row, multiplied by the distance between the rows. For instance, plants are set in rows 4ft. apart, and the plants are two feet apart in the rows: 4 times 2=8; therefore each plant has a space of 8 square feet. Divide 43,560 by 8, and you have 5,445 plants per acre. If trees are planted 30 ft. apart each way, each tree has a space of 900 square feet, which, divided into 43,560 gives about 48 trees to the acre."

In some experiment stations in the Tropics experiments have been made on areas of a few square feet each and the results multiplied by 500 or 1,000 or a similar high multiple to obtain the results per acre. The absurdity of such calculations is obvious. The late Mr. G. S. Jenman in the last of his annual reports made some calculations in this manner, to which with characteristic irony he added the proviso " The grower would certainly not receive one-third of this."

Cacao Disease and Shade.

The common cacao pod disease is now universally attributed to *Phytophthora*, a species which has been named *Phytophthora Faberi.* Von Faber agrees that is is always worst in damp situations. This is in agreement with the results obtained on the Experiment Station Peradeniya, where a striking decrease in the number of diseased pods followed the removal of the dense shade.

—T. Petch (Gov. Mycologist) in Tropical Agriculturist, May, 1910.

The Model Gardens.

Record of Attendances.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907:—

	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E.B.	Total Attendances.
1907									
April 1 to June 30	305	337	412	329	12	...	...	...	1,395
July 1 to Sept. 30¶	381	298	202	285	256	...	...	...	1,422
Oct. 1 to Dec. 31	575	293	380	221	288	...	...	...	1,757
1908.									
Jan. 1 to Mar. 31	597	731	389	299	187	...	...	...	2,203
April 1 to June 30	1,438	860	183	274	243	...	...	...	2,998
July 1 to Sept. 30¶	1,698	976	440	199	212	...	...	...	3,552
Oct. 1 to Dec. 31	1,714	819	465	115*	411†	160‡	...	...	3,684
1909.									
Jan. 1 to Mar. 31	1,638	710	338	463	370	302	...	...	3,821
April 1 to June 30	1,707	677	329	142	288	446	...	...	3,589
July 1 to Sep. 30¶	1,252	742	433	436	172	378	223‖	...	4,636
Oct. 1 to Dec. 31	1,876	536	438	236	362	771	439	...	4,858
1910.									
Jan. 1 to Mar. 31	1,282	769	287	370	259	489	465	..	3,921
April 1 to June 30	1,311	558	797	894	303	455	519	403§	5,240
July 1 to Sep. 30¶	1,234	526	910	748	294	510	498	537	5,257

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during the instruction given by the Superintendent Teacher. It has not yet been found feasible to keep a record of the many attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.
¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to October 13, 1910. The corresponding figures for the three previous years are added for convenience of comparison :—

	1907	1908	1909	910
Product.		January 1 to October 13.		
Sugar, tons	55,654	59,624	62,002	46,920
Rum, gallons	1,129,445	1,203,635	1,322,195	1,211,772
Molasses, casks	372	164	426	631
Cattle-food, tons	5,206	3,727	5,799	4,751
Cacao, cwts.	592	885	533	443
Citrate of Lime, cwts.	3	13	49	76
Coconuts, thousands	313	152	450	681
Copra, cwts.	...	...	423	210
Coffee, cwts.	2	57	1,120	978
Cotton, lbs.	63	...	...	...
Fruit, brls. and crates	3	50	1	...
Ground Provisions, value	$2,318.58	$1,765.06	$216.32	$546.12
Kola-nuts, cwts.	32	...	38	9
Rice, tons	2,154	2,712	3,741	4,141
Rice-meal, tons	196	1,937	1,448	1,555
Starch, cwts.	27	...	...	4
Cattle, head	944	1,241	789	1,049
Hides, No.	3,625	2,979	2,549	4,574
Pigs, No.	418	585	708	872
Poultry, value	$ 377.06	$ 229.72	$ 184.20	$67.08
Sheep, head	162	32	53	122
Balata, cwts.	6,778	6,521	5,647	6,570
Charcoal, bags	64,908	59,166	61,772	71,222
Firewood, Wallaba, etc., tons	4,723	5,670	6,709	7,509
Gums, lbs.	4,079	854	6,512	1,507
Lumber, feet	43,384	45,248	175,622	202,027
Railway Sleepers, No.	4,000	1,000	2,500	5,700
Rubber, cwts.	37	40	45	12
Shingles, thousands	1,302	2,291	1,332	1,802
Timber, cubic feet	192,954	157,333	221,066	222,681

Planting Table.

In the last two numbers of the *Journal* has appeared a planting table compiled by the late Mr. G. S. Jenman, F. L. S. This table has been revised, and the following, giving the distances at which the various crops of the colony should be planted, the width of beds and the average number of plants per acre, should form a guide for farmers :—

Crop.	*Distances between plants.*	*Width of beds.*	*Number of plants per acre.*
	Roods	Roods	
Bananas or plantains	1¼ x 1¼	2½—3	192
,, ,, ,,	1½ x 1	3	200
Cacao	1¼ x 1¼	2½—3	192
Coconuts	2 x 2	4	75
,,	2 x 2½	4	60
Coffee (creole)	1 x 1	3	300
,, (Liberian)	1¼ x 1¼	3	192
,, ,,	1½ x 1	3	192
,, (robusta)	1 x 1	3	300
Fruit Trees—Avocado Pears	2 x 2	2	75
,, ,, ,,	2½ x 1½	2½	80
,, Guavas	1¼ x 1	2½—3	250
,, Mangos	2 x 2	2	75
,, Oranges	1½ x 1¼	3	160
,, ,,	1½ x 1½	3	133
,, Sapodillas	1½ x 1½	3	133
,, Star Apples			
Ground Provisions—(cassava, tannias, eddoes)	1½ x 1½	3	1200
,, ,, (corn)	½ x 2	feet 3	3600
Limes	1¼ x 1¼	2½—3	192
,,	1½ x 1¼	3	160
,,	1½ x 1½	3	133
Nutmegs	1½ x 1¼	3	160
Rubber (Para)	1¾ x 1¾	3½	100
	2 x 2	4	75
Rubber (Sapium)	1¾ x 1½	3½	115
	2 x 1½	4	100

It is recognised that the above table may not be followed absolutely as the distances ultimately decided upon must depend upon the

situation of the land. In no instance should plants be put closer together than as given above, and when the lesser distance is chosen it is advisable that the plants should be put in quincunx, *i.e.*, the trees of one row should alternate with the trees of the next, so that any four trees taken in the field form a diamond.

The width of the beds will vary somewhat according to conditions but it is important to recognise that if two or more rows of plants are put into one bed that sufficient space should be left between the rows of plants and the drains. The mistake of planting rows of plants too near the small drains is far too common in this colony.

The number of plants per acre has been calculated on the assumption that the two-foot drains are dug without the distance between the rows of plants on either side of these drains varying from the distance between the rows on the bed.

F. A. S.

Salt for Storing Maize.

There is one possible method which an American farmer some ten years ago discovered accidentally, and which he declared to afford absolute immunity against the weevil. One year he sacked up a lot of cow-peas, and one-fourth of the sacks used were salt sacks, with the salt still clinging to them. When he marketed the peas he found those in the salt sacks were in perfect condition, whilst those in the other sacks were almost destroyed by weevil. It has been suggested that maize might be stored unhusked, but it is in the husk that a great many weevil secrete themselves and afterwards destroy quantities of the grain. This farmer, knowing this, dissolved a quart of salt in 2 gallons of water, and, as the unhusked cobs were thrown into the barn, he gave each layer a slight sprinkling of the salt solution. There was not the slightest damage from the weevil, and he has, he says, used the salt remedy ever since with perfect success. This is such a very easy remedy that Queensland farmers might take the trouble to make an experiment and find out for themselves the correctness or otherwise of the statement.

—Queensland Agric. Journal, June, 1910.

Selected Contents of Periodicals.

Improvement of Crops by Selection (R B. Greig), August.
The Relation of Co-operation to Small Holdings.
Mendelism and its Application to Stock-breeding (A. B. Bruce, M.A.) July.
—Journal of the Board of Agriculture (England), 1910.

Wheat—(Papers read at a meeting of the British Association, at Winnipeg, Aug., 1909. Published as supplement to Journal of the Board of Agriculture, England.)

Eradication of Ticks by the Starvation Method.
The Turkish Tobacco Industry in Cape Colony.
Agricultural Zoology (*Insects and Arachnida*) (May)
A Further Note on the Drug Treatment of Biliary Fever or Malignant Jaundice of the Dog (*Canine Piroplasmosis*).
—*Agric. Journal, Cape of Good Hope, 1910.*

The Cultivation and Preparation of " Bright " Tobaccos.
The Cultivation, Preparation and Utilisation of the Ground-nut.
—Bulletin of the Imperial Institute : Vol. VIII, No. 2.

Agricultural History and Utility of the Cultivated Aroids.
—U. S. Dept. of Agriculture ; Bulletin No. 164.

Notes on Ceara Rubber in German East Africa.
—Agricultural Journal, British E. Africa. Vol. II, p. iv.

The Diseases of Cacao (T. Petch).
—Tropical Agriculturist, May, 1910.

Potato Blight (Phytophthora infestans)
Coffee Cultivation in Queensland.
Cultivation of Sugar Beet in England.
—Agric. Students' Gazette : R. A. C. Cirencester.

The Study of Sugar Cane Insect Pests.
The Royal Commission on Mauritius.
—International Sugar Journal, August, 1910.

Biology of the Froghopper.
—Proc. Agric. Soc., Trinidad and Tobago, September, 1910.

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Sidelights on Agricultural Research.

Some interesting points are raised in a report by Professor T. H. Middleton on the distribution of grants for agricultural education and research in the years 1908-10 recently "presented to both Houses of Parliament by command of His Majesty" as the official phrase goes: points which though primarily concerning the United Kingdom may repay consideration by the public of this portion of the Empire.

Nowhere has the subject of State-aid for agricultural research been taken up with more avidity than in the United States of America, and it is there that results have been most striking and available. First in the field, the States have 20 years of accumulated data to work upon. A people naturally quick and impressionable, eager to adopt new ideas and panting to carry them out, the Americans are unfortunately deeply and universally afflicted with the curse of commercialism. Ideas must be readily translatable into dollars; notions must be negotiable, and success be measured in terms of greenbacks. As we once heard an American put it: "If I can put down $10 to your 10 cents, I'm your God." Hence it is not surprising that in that country the question "What is Research" has been raised of late years and debated with some asperity. The big commercial firms who have engaged skilled scientists and provided them with laboratories (often grudgingly and at a cost which may work out at a fraction of what they would willingly spend in advertisement) are disappointed that commercially valuable results are not turned out to order. The American public, which pays for the Agricultural Experimental Stations, clamours for "early results." The taxpayer wishes to see a return for his contribution. "Nothing is more certain" declares Professor Middleton, "than

that much of the best work, and the work which most deserves the aid of the State, is of a kind which cannot be hurried, or than that no genuine scientific worker can grind out results to order."

Elsewhere he mentions that "one of the chief difficulties which those responsible for the advancement of experimental work in America have to contend with, is the result of uninformed public opinion." That is a very wise remark and applicable to many other places than America. And, we fear, the popular press—in so many respects the fashioner of public opinion—cannot wholly be acquitted of blame in the matter. The times call for sensationalism : sensational statements, politics embodied in a catch phrase, striking summaries of intricate investigations : and such a spirit is the antithesis of the scientific. Infinite harm has already been done by premature or inaccurate statements of the results of medical research ; as much seems likely to arise from the endeavour to force the hands of the agriculturists. Mendelism has occupied the minds of investigators of late ; at once the press announces that the problem of heredity has been solved and that plant-breeding to order has become a commonplace. Only those whose business it is to read daily the immense and ever-increasing volume of literature on the subject, and whose training enables them to form a judgment on, and to endeavour to interpret, the results, can realize the bewildering intricacy and uncertainty of the subject. We shall deal with this question more fully later : an allusion to it in this connection will suffice.

Summing up, the Professor defines "research " thus :—" In order that work may become research it must satisfy one or both of two conditions : (1) it must, as a result of observation or experiment, result in the collection of fresh facts ; (2) it must involve an examination of the facts collected, or phenomena observed, and the reduction of them to a form in which they constitute an addition to knowledge." That is an excellent test by which to judge the work of any Agricultural Department, as shown by its Progress Reports : and is one by which we abide with confidence.

Yet another point which Professor Middleton makes is the necessity for decentralization in connection with agricultural work. He considers the suggestion of a State Research Station for the United Kingdom and comes to an adverse conclusion regarding it. " It is only necessary to examine the character of the work to be done," he remarks, " to see that much of it must necessarily be local. The diseases of animals and plants might

be studied with advantage up to a point at one central institution for the whole country, but when methods of prevention and remedy come into the question, and this is more especially the case with plant diseases, local study is essential. The breeding of new plants is to a certain extent a local problem, for different qualities are required in different districts. Questions bearing on the cultivation and profitable treatment of soil are usually of a local character." We should like to press the point home. We confess to a weakness for the contention that British Guiana is big enough and rich enough and "different" enough to be independent—to do its own work its own way and to stand on its own legs. Yet continual endeavour is made in certain quarters to cramp us down to some foreign criterion. Our scholars must be uniform with the Barbados standard; our examinations must be identical with those of Barbados; our teachers must be educated in Barbados; the original work done here must be stamped with the Barbados hall-mark; our research must be "directed" from Barbados. "There is little energy to be got out of reflected light" says the authority we have quoted, setting up the standard that scientific agricultural work is incomplete until the farmer is reached by it, "and the enthusiasm of farmers cannot be aroused over foreign work . . . Because *of the difficulty of influencing an agricultural community at a* distance it seems to me therefore to be unlikely that one central station would be satisfactory in England." *A fortiori*, when the circumstances are considered, a "central" foreign station would benefit British Guiana still less. A better case for establishing strong men in local centres and leaving them to work out the agricultural salvation of the district assigned to them, free from outside interference, we have never encountered.

A Young Science.

Facts to be of value and a safe basis for reasoning need to be correlated and given their proper weight. Isolated facts are dangerous things when considered out of their environment and given undue proportion. Science is knowledge classified, correlated, and arranged in an orderly manner, and the office of science is to study the sequence of phenomena. In agricultural economics very little of the knowledge on which to base a science is yet available, and very little of the study of the sequence and relations of phenomena or facts to furnish a body of scientific investigation is to be found.

"The Economic Condition of Agriculture" from The Expt. Station Record, U.S. Dept. of Agric., March 10, 1910.

Notes.

The Agricultural Conference.

It is with regret that we have to announce that the Agricultural Conference of 1911, which should fall to the lot of British Guiana, has been postponed. The Commissioner of Agriculture for the West Indies (the Hon. Francis Watts, C.M.G.,) paid a visit to Demerara in October to arrange matters, and an approximate date in January for the conference was then fixed. Owing to the uncertainty of the Mail service, however, and other circumstances, the arrangements could not be carried out, and for the present the meeting is postponed *sine die*. A cordial invitation is extended to all interested in agriculture in the colony, and especially to grantholders and small farmers, to attend the conference, when its sittings commence.

The Amateur Rubber Expert.

The rubber boom has been responsible for many queer phenomena—chiefly financial—and some quaint products—mainly human. Of these last the amateur "rubber expert" has, perhaps, been the quaintest. As his genesis has been something of a puzzle to many residents in the tropics, who, in their innocence, have wondered at his sudden appearance clothed in wealth and assurance, we submit to our readers a curious paragraph from "The American Review of Tropical Agriculture" which was at the time concerned with the influence of the rubber boom on Mexico. "It was not," writes the editor, Dr. Pehr Olsson-Seffer, "the way of the native planter to advertise to the world at large his new source of income. He was too indolent and too ignorant to do such a thing. It remained for some American traveller with a promoter's eye to see the future of this planting development. In a very short time rubber plantation companies began to appear throughout the length and breadth of the United States. The Yankee, with his usual desire to get rich quickly, realized that to him, as promoter, the first thing of importance was to persuade the public that he had a good thing to offer. There was no special difficulty in this feature, and the public was not slow in subscribing to these new schemes. In many instances the money destined for the development of rubber plantations in Mexico never went beyond the border of the great North American Republic. Where the promoters were honest enough not to pocket the entire capital of the company, personal influence was brought to bear in the appointment of local managers and superintendents. Any business man with a reputation as such, whether he had been engaged in the druggists' shop, in the

hardware trade, in the dry goods store, on the Stock Exchange, or behind the accountant's counter in a bank, was considered a fit person to go to Mexico to manage a rubber plantation. That he knew nothing at all on the subject of tropical agriculture, that he had never seen the tropics, did not speak a word of Spanish, and had no idea of what he was going to do except to spend money, was of no importance. 'Anyone,' it was argued 'can look after a few Mexican peons and get the work out of them.' The principal recommendation of such a man was that he was the cousin or son-in-law or other relative of the president, or some other official of the company. He left for the unknown country with full power and with a fat bank account. He spent money freely, he made big clearings, five to six thousand acres the first season, which he was never able to plant, and after a year or to two of bluffing the stockholders with fine reports, he retired voluntarily, or his resignation was demanded by angry stockholders, who woke up to the realization that most of the invested money was gone, and that they had on their hands a large tract of undeveloped tropical land ; in fact, a white elephant which they could not handle." This paragraph, we suggest, may explain the puzzle to the puzzled : or, on the other hand, it may not. Perhaps we are fortunate, in British Guiana, in having had but little experience of the type of gentleman referred to.

The Toronto Exhibition.

In common with similar bodies in some other colonies, the Permanent Exhibitions Committee of British Guiana was awarded a Gold Medal at the Toronto Exhibition of 1910 ; but that Committee would be the first to acknowledge that their success must be attributed rather to the excellent support they received from exhibitors than to their individual efforts. It is even possible that Messrs. Sandbach, Parker & Co. might have been the more proper recipients of the medal awarded to the Committee, as it was their efforts during late years and their kindly assistance that rendered possible the conferring of the medal on the Committee. Mr. Walcott, the representative of their firm in the Dominion, deserves to share with Messrs. Sandbach, Parker & Co. the thanks of the community for his attendance during the Exhibition, and for the valuable critique on the British Guiana Exhibits which he has written to the Permanent Exhibitions Committee and of which the Committee will doubtless make good use when arranging for future Exhibitions. To Messrs. Pickford & Black (and especially to Mr. C. S. Pickford) is due warm recognition of the indefatigable manner in which they promoted the interests of the colony. Not only did the firm carry the exhibits free of charge, but they took the respon-

sibility of handling the goods and staging them—an onerous task which was most skilfully and completely carried out. We take this opportunity to congratulate the Hon. B. Howell Jones and Mr. J. Gillespie—members of the Board of Agriculture—on the success they achieved with the Houston sugar ; Mr. T. E. Earle, another representative of the Board, on the reward which attended his exhibition of cacao ; and the other gentlemen the merits of whose contributions to the Exhibition were duly recognized in Canada.

The Nature of Agricultural Experiment.

We have elsewhere in this number of *The Journal*, quoted one eminent authority on the subject of Agricultural Research : we think a paragraph from Professor Harrison's "Lectures to Teachers" might be given a wider publicity in this connection. It sums up in very concise and lucid fashion the nature of Agricultural Experiment—a matter upon which the vaguest notions seem to obtain among the general public :—"There are still many problems in connection with agriculture yet unsolved and which will require the acutest reasoning and the deepest research to work out. Here we cannot do much in a day. Time has to be waited on. When you take up the subject of plant growth, and you desire to find out by experiment all the conditions most favourable to the most profitable crops, you have to go patiently. You make an experiment in one year and obtain certain results. Next year you repeat it in order to verify those results, but the weather conditions have perhaps changed, and you get results varying essentially from those before obtained. You try again, and now perhaps the tillage has not been the same or other conditions may have been different, causing difference in results. You must persevere in putting questions to nature if you hope finally to derive the understanding which you started out to seek." That is the spirit of Agricultural Research in a nutshell.

Sunlight and Fungi.

In the October number of the "Proceedings of the Agricultural Society of Trinidad and Tobago," Dr. C. J. J. van Hall (till quite lately Director of Agriculture in Suriname and now in Buitenzorg, Java) contributes an article explaining a statement made in his paper on the "Witch Broom" Disease of Cacao regarding the influence of sunlight on fungi. At the time of its appearance, we gave a summary of the French edition of Dr. Hall's valuable contribution, and therein the statement referred to appears in the form "the opinion which has become an axiom, though absolutely erroneous, that sunlight is unfavourable to moulds (fungi).* In

*See *The Journal* Vol. II, No. 3 (January, 1909) p. 129.

Dr. Fredholm's translation of the original Dutch, the sentence reads: "They reasoned in accordance with the axiom accepted, but nevertheless entirely wrong hypothesis, that sunlight is injurious to fungi." † Such a statement, coming from such an authority, aroused some curiosity and comment, which culminated in a question put by Mr. A. B. Carr at a general meeting of the Agricultural Society of Trinidad and Tobago. The subject was discussed, quotations bearing on it were extracted from the reports of Mr. O. W. Barrett, Sir Daniel Morris, and Mr. E. Agar, and the late Mr. J.B. Carruthers and Dr. Fredholm contributed their views. The prominence given to the isolated extract prompted Dr. van Hall to write an explanatory article (Society Paper No. 436) in which he defined the position exactly. Dr. Fredholm had already pointed out that Dr. van Hall's statement was meant in its broadest sense; and that the difficulty in accepting it arose mainly from preconceived ideas of fungi drawn from common—"domestic"—examples such as moulds and mildews which are notoriously lovers of darkness and moisture and are checked by the direct influence of sunlight. Dr. van Hall's explanation follows the same lines. He refers to the investigations of Duclaux, where the growth and vitality of fungi were not influenced by sunlight, and quotes Brefeld's researches to prove that light is necessary for some fungi to form their fructification-organs; and, while not denying that in some instances sunlight has a bad effect on some fungi he concludes "that the main result is: sunlight has, *as a rule*, no bad influence on fungi, except of a few cases; to many fungi, however, its presence is a stimulant or even a necessary condition to the formation of fructification." These conclusions, he is careful to point out, apply to fungi in the strict sense only: bacteria behave in another way and are, generally speaking, damaged in their growth and vitality by light. Further he is careful to distinguish between the *direct* and the *indirect* effect of sunlight, and concurs with Dr. Fredholm that the destructive effect of sunlight on low organisms may be due to the heat associated with it and to which evaporation is due. Dr. van Hall instances the "Krulloten" (Witch-broom") fungus (*Colletotrichum luxificum*) as one which is indifferent to the thinning out of shade trees. The lesson to be drawn from the discussion is well put by Dr. Fredholm,—"the danger lies...in following 'Rule of Thumb' methods, or in relying on statements only partially complete and true but so often repeated that they have become accepted as full and absolutely correct and are being blindly followed without receiving due consideration and criticism."

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† **Agricultural Society of Trinidad and Tobago: Society Paper No. 404.**

Cultivation of Rubber in British Guiana.

(Continued.)

When the seedlings have been planted out in the fields, the question of after-cultivation has to be considered. As far as this colony is concerned, clean cultivation, as is practised on many of the rubber estates of the East, is not feasible. On several of the properties on which rubber is being cultivated in British Guiana catch crops of provisions have been grown without detriment to the rubber.

INTER AND CATCH CROPS.

The principal inter-crops that have been grown are corn, tannias, eddoes, cassava, and yams. In the North Western district it is usual, after the land is freshly cleared, to take off crops of provisions for three or four years before the land is planted in rubber. If rubber were planted immediately after the land was cleared inter-crops of provisions could be grown in between the rubber for the first three years without apparently retarding or injuring in any way its growth. In planting these inter-crops, it is of the greatest importance that they should not be planted too thickly nor too close to the rubber trees. The rubber should always be considered as the main crop, the inter-crops only being planted to keep down the growth of the weeds and to assist towards meeting the expenses of the first few years. In the first two years such crops as tannias, eddoes and yams can be grown, but after that time they should not generally be planted, as the harvesting of them necessitates a considerable turning up of the soil and damage to the roots of the rubber. Forking in rubber would not do any appreciable damage if it were carried out at the correct time, but often the harvesting of these crops becomes necessary at a time that is very unsuitable for the rubber and therefore it does much harm. For this reason the continuance of growing these ground provisions is not to be recommended. Bananas planted widely and with not more than three suckers growing in each stool can satisfactorily be used as a catch crop, while pigeon peas can also be utilized for the same purpose.

Recently an interest has been taken in Robusta coffee. This coffee thrives well on our river lands and some excellent results are being obtained from trees growing on lands up the Demerara river. This coffee, as has been mentioned in previous numbers of the *Journal*, is an early bearer and is being used largely as a catch crop with rubber in Java and the East. Quantities of this coffee are now

being planted for trial in various localities of the colony, and experimental plots have been planted at the Pomeroon Experiment Station as a separate crop and as a catch crop with rubber. With rubber planted two roods apart in quincunx, the coffee might be planted 8 feet apart, two plants being placed between each pair of rubber trees with four plants in the middle of the square around the centre rubber plant. These plants should all be topped at about 5 feet and after four or five years half of them should be removed, leaving only the plants in the rows in order that tapping may be readily carried out.

Growing inter-crops of provisions or the utilization of Robusta coffee as a catch crop appears to be an economical method of bringing land under cultivation in rubber, but it must not be forgotten that the aim of every rubber estate should be to bring in an economic manner and in the shortest possible time an area of evenly grown healthy trees to a stage when tapping may be commenced, and therefore inter-crops and catch crops on rubber estates should be delegated to second place. Inter-crops of provisions can be grown for the first four years, while Robusta coffee might be continued in favourable situations for five or possibly six years. As soon as systematic tapping operations are commenced the question whether catch crops are to be continued has seriously to be considered.

WEEDING.

The growth of inter-crops reduces the weeding expenses considerably, but the land should always be gone over periodically and weeding carefully carried out. After inter-crops are discontinued, the question of weeding has to receive consideration. The usual practice here is to allow the weeds and grass to grow and then cutlass them down every three or four months, the cut weeds being commonly used as a mulch around the trees. A very common mistake has to be noticed here. Mulch should never be piled around the trunks of the trees. It serves no useful purpose there. It should be spread evenly in a circle at least 1 yard from the trunk of the tree, and the larger the trees the greater should be the unmulched circle immediately around their stems. All undergrowth and bush must always be kept down, and in some situations it has been found necessary to 'brush' the rubber fields oftener than three or four months to remove the bush and undergrowth that springs up. No bush should be allowed at any time to reach more than three or four feet in height or otherwise the growth of the rubber may be retarded. It has been found at the Issorooro Experiment station that the growth of bush on the hill lands has been much greater than it has been on the flatter lands.

Whereas it is desirable on all the steeper hill lands to obtain a turf of grass and weeds as early as possible in order to prevent wash, it has been decided to experiment in keeping down all the bush and weeds on these plots by cutlassing every month. This experiment has been in operation for only a few months but it is already obvious from the growth of the rubber that the monthly weedings on these hilly lands are having a most beneficial result, and as the expenses of weeding are reduced every month by reason of the smaller amount of growth it would appear as if this method is likely to prove by far the more economical.

Clean weeding has been practised on some beds, and it would appear that nothing is gained by keeping the land clean-weeded. A small experiment that has recently been tried points to a more rapid growth in the rubber if the land is kept covered with some growth. From our experiments, therefore it is indicated, so far, that on hilly slopes monthly weedings are desirable, while on flat lands weedings carried out every three or four months with the intelligent use of the weeds as mulch are giving satisfactory results provided that the undergrowth and bush is kept down as occasion demands. For a general consideration of the "Treatment of Weeds in Permanent Crops" reference should be made to the article in *The Journal* for April 1909 (Vol. II, No. 4.)

COVER-CROPS.

The system of growing cover crops, preferably of leguminous plants, to smother out weeds has received considerable attention in rubber plantations in the East, and is now being experimented with in this colony. Trials have been made by the Department of Science and Agriculture with many plants which it was thought might prove suitable for cover crops in this colony. The trials so far have given the following results :—

Experiments have been made with *Crotolaria striata*, *C. retusa*, *Canavalia ensiformis*, *C. obtusifolia*, *C.* sp. from Antigua, *Phaseolus semierectus*, *Tephrosia purpurea*, cow peas, Bengal beans and dwarf bonavist beans. *Crotolaria striata* has been found to be very difficult to establish, especially on the heavier lands, but when once established it makes vigorous growth. It is, however, woody and often grows to a height of nearly 7 or 8 feet. *C. retusa* does not grow satisfactorily. nor have the three different species of *Canavalia* been found suitable to our heavier lands. *Phaseolus semiere tus* is difficult to establish, particularly if there are many vigorous growing weeds, but *Tephrosia purpurea* promises to be of value. Cowpeas quickly mature and they have been found not to ratoon. Constant

re-sowing would therefore be necessary but on the lighter hill lands they might prove useful. Bengal beans grow luxuriantly but are vigorous climbers, and will have to be experimented with carefully in permanent cultivations before they can be recommended. Dwarf bonavist beans are promising for some situations. Further trials are now being made with *Crotolaria striata* and *Tephrosia purpurea* at the Experiment Stations in the Pomeroon and North Western districts, while several varieties of *Crotolaria* and other plants are being experimented with at the Botanic Gardens and will be sent to the out-stations as soon as seed is available.

The advantages of the cover-crop system are that control is kept over the growth between the rubber, that the leguminous crops benefit the soil and that a larger amount of material is available for mulching purposes. The cover-crops should, however, not grow too tall or be too woody as it makes it difficult to carry out field operations, neither should they be vigorous climbers or otherwise the rubber trees may become smothered.

PRUNING AND TOPPING.

The pruning of *Sapium Jenmani* and the topping of Para rubber are operations that require to be carefully carried out. *Sapium Jenmani* has a tendency to grow bushy, and therefore pruning should be done systematically. In the earlier stages the lower branches may be entirely removed, but when the tree has reached six or seven feet in height, the system advocated in this *Journal* (Vol. II. No. 2) has given the most satisfactory results. This method is as follows :—As soon as the branches have grown to, say, 3 feet in length before secondaries are formed, they are pruned back to about half their length, with the exception of the top whorl of branches necessary to carry up the head. Later, when the trees grow further, what was the top whorl at the last pruning is shortened and the lower branches are completely removed, and this method is continued until a good clean stem is procured. The branches should not be allowed to become more than $\frac{3}{4}$ inch thick before they are entirely removed or otherwise scars will be left which will take some time to heal and then produce an uneven bark, but never should a tree be so pruned that it has not sufficient leaf area to satisfactorily carry on its growth. It is desirable that a good clean stem up to eight or ten feet should be obtained and then it is only necessary to do such pruning as is required to prevent the "head" of the tree from becoming too heavy. Sapium is very brittle and heavy 'heads' are frequently damaged by wind. All dead branches should be removed, and where a tree is found in which the main stem has been dwarfed by the production of large

laterals—and these cases are not infrequent—efforts must be made by careful pruning to make one of these laterals or one of its secondaries carry on the functions of the main stem.

Para rubber requires but little pruning. It grows as a slender upright tree for a height varying from 10 to 30 feet before it commences to branch. It would appear that the locality frequently determines at what height the majority of the trees branch naturally. The question of topping has been debated in the East and there are many advocates of topping and equally as many against topping. From our experience with Para rubber in this colony it seems desirable that the trees should be topped in sheltered situations at a height of from 12-15 feet while in windy localities it seems desirable for the topping to be done at 10 feet. When trees are topped, the heads are much more evenly balanced, and the annual increase in girth of topped trees has been found to be much greater than has been the increase in non-topped trees. When Para trees branch naturally, it has been frequently observed that the first branching is the production of a single branch which grows at first almost at right angles to the main axis, while subsequent branchings are often irregularly distributed. The first branch has often to be removed, and topping sometimes has later to be resorted to. Where Para trees commence to branch naturally at about eight feet, as they occasionally do, it does not seem necessary to prune back these branches as eight feet would give sufficient height for tapping to be carried out. Sometimes, however—mainly through injuries—the trees may send out a branch at the level of the ground or slightly higher. This branch should be removed or otherwise neither the main stem nor it will attain satisfactory girth measurement.

RATE OF GROWTH.

The rates of growth of rubber trees at the Issorooro Experiment Station are being carefully recorded, each tree in section D. being measured at the base and at three feet from the ground twice a year, while measurements are also being recorded at Onderneeming and at other stations. Sapium grows at first more rapidly in both height and girth than does Para rubber, if the conditions are equally suitable to both kinds. Subsequently, however, the Para rubber grows in height the more rapidly and there are indications of a more rapid relative increase in girth after the first two or three years. All the measurements that are available in this colony are of very young trees, and it is impossible to do more than compare these measurements generally with figures available from the East. In favourable localities the growth of Para rubber both in height and in girth during the early years indicates generally that

it compares most satisfactorily with average growth in the East. There is also every indication that this rate is being maintained even under the methods of cultivation practised here. Actual comparisons of measurements cannot be made as the methods of cultivation are totally different, and practically the whole of the Para rubber in this colony has been grown from basket plants.

The yearly increase in growth varies according to the soil, situation, climate, etc., and it has been ascertained in the East that the rates of increment also vary according to the age of the tree. The rate of growth in the early years cannot be definitely given, but in two years the girth at three feet from the ground should be from 5 to 9 inches, although it is probable that many trees may not have attained a measurement of five inches, while the yearly increment after two years up to five years should be from three to six inches per year. After five years Mr. H. N. Ridley estimated that in the Straits Settlements the rates of growth where the general conditions are fair should be :—

From 5 to 15 years	..	.. 3 to 4 inches per annum.
From 15 to 20 years	..	.. 2 to 3 inches per annum.
From 20 to 30 years	..	.. 1 to 2 inches per annum.

Where trees are closely planted, the rate of growth in girth measurement is considerably reduced, particularly after the first few years, and instances in Singapore Botanic Gardens have been given where closely planted trees gave on an average but ¾ inch increase per year while wider planted trees gave 2¼ inches per annum. A good guide as to whether trees are making satisfactory growth during the second to fourth years is that the ground measurement of the trees of one year should be approximately the three-foot measurement of the next year. That is, trees after the first two years should increase in girth by the difference between these two measurements for the next two years.

Owing to the very uneven way in which Para rubber grows during the earlier years, only average increases should be considered. The measurements of a few trees compared with average measurements are often misleading, and therefore all estates making measurements should see that the results represent the average for the estates.

PESTS AND DISEASES.

Very few pests or diseases have, fortunately, been noticed so far on the rubber in this colony. Sapium has been affected in different parts with scale insects. The attacks have been slight and there

seems to be no reason why these pests should not be kept in check provided ordinary precautionary measures are taken. In *The Journal*, Vol. III, No. 1, an account is given of the scales found on Sapium, and it is recommended that where they are noticed in any quantity that spraying with rosin compound be undertaken. Spraying has been carried out at the Issorooro Experiment Station with success, and some of the rubber companies are adding knapsack sprayers to their outfits.

With the exception of two 'leaf-spotting' fungi found on the leaves of Hevea quite recently and small snails found on plants growing at Arakaka, no pest or disease has up to the present attacked Para rubber in this colony.* Cultivators should always be on the look-out for any signs of pests or diseases and should *immediately* forward specimens for examination by the Department. Root disease has occasioned much damage in many of the Eastern rubber properties. It should be carefully looked for here, and all suspicious cases reported, so that prompt assistance can be rendered. Wood ants may prove troublesome when tapping is commenced and they are becoming destructive to some of the forest trees that are being tapped at Bonasika Rubber Reserve. Acoushi ants also give trouble, but these can be destroyed by puddling or by carbon bi-sulphide.

J. B. HARRISON.

F. A. STOCKDALE.

(*To be continued.*)

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* Since the above was written instances of young heveas being defoliated by caterpillars have been reported. This attack is being investigated. Up to the present only a very little damage has been done.

The Only Reason.

The first, last and only reason for managers, assistants and coolies being employed on the (rubber) estate is the production of latex. The one aim and object of all expenditure of money and labour is the production of the greatest quantity of rubber of the best kind at the lowest possible cost.

C. Alma Baker in "Agric. Bulletin," F.M.S, Sept, 1910.

The Purification of Muddy Waters.

Much of the water available in the State of Victoria* is rain water stored in open tanks with puddled clay embankments and floors. Such water is practically never clean, but generally discoloured with a fine suspension of mud.

This mud is so finely divided that it does not sink under the force of gravity nor can it be separated under the greater force exerted by the centrifugal machine. In the language of physical chemists, it is in a condition of "colloidal suspension," and its separation from the water requires either an effective filter, or the use of a chemical re-agent.

FILTERS.

An effective filter is, however, generally speaking, a slow filter, and will not allow large volumes of water to pass in short intervals of time. Further, they are costly to buy, and unless treated with care, and regularly cleaned, they may signally fail to purify water which contains harmful bacteria. In fact, a badly cared for filter may be a source of actual danger, for bacteria may thrive in countless numbers amongst the material collected in the filter, and may later be washed through into the filtered water.

CHEMICAL PRECIPITATION.

By the second process of purification, namely, chemical precipitation, no expensive initial plant is required, large volumes of water may be satisfactorily handled, and any one of good commonsense can control the process, whereas the management of a filter requires a skilled and intelligent man. It is this second type of process which will now be discussed.

The visible impurity in "muddy water" is, as already mentioned, a fine "colloidal suspension" for which the silicates of the puddled clay floor are largely responsible. On the addition of certain chemicals this fine suspension alters in character.

The extremely minute particles, which, owing to their smallness, were able to float in the water, begin to collect together until they form large flocculent masses.

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*The methods advocated in this article are (as experiments conducted at the Government Laboratory, British Guiana, show), applicable to local surface waters heavily charged with humic acid in combination with iron—such as Lamaha and many other creek waters.—ED. *J. B. of A.*

These masses, which are easily seen to form a bulky precipitate, settle to the bottom of the water at a speed depending on their weight, and the manner of their formation, but the important point is that they do settle to the bottom, and at a rate which is perfectly satisfactory from the practical standpoint. When the precipitate or flocculi have thoroughly sedimented, the water above is perfectly clean and sparkling.

The whole process, to make a comparison, is exactly similar to the clearing or "fining" of wine, whereby after the sedimentation of flocculi the wine is left bright and sparkling.

The clean water above the suspended mud is completely free from even the finest suspended particles.

Its Bacterial Purity.—It is a well-known fact that bulky flocculi, separating in a fluid, enclose and carry down with them the micro-organisms present at the time. In this way, the falling mud removes from the water the bacteria polluting it.

A number of Australian waters cleared by chemical means have, through the kindness of Dr. Bull, been examined at the Bacteriological Laboratory of the University of Melbourne, and the reduction in the number of organisms present has been most pronounced. Not only does the settling mud remove bacteria, but it also carried down the eggs of hydatids, thus giving the means of protecting stock against the most fruitful source of hydatid infection—dirty drinking water.

It is only the actively swimming water Crustaceæ which escape the precipitating action of the mud, and they do not live long in the clean water, owing to an absence of food supply.

The Selection of a Chemical Precipitant.—The ideal substance would be a cheap salt of aluminium, iron or chromium. From the practical point of view, the cheapness is almost as important as the chemical efficiency, and consequently for actual use only the following need be named, viz., alum, chloride of iron, lime.

The last of these is able to compete only on account of its cheapness. It is especially to be noted that it is not nearly so "brilliant" in its action as either alum or chloride of iron. It is, however, a practical substance to use.

In choosing between alum and chloride of iron, the price is at first sight in favour of the former. Weight for weight, however, 1 lb. of chloride of iron is worth 2 lb. of alum, and this fact, together with its easy solubility, turns the scale in its favour.

The "brilliancy" of the action of iron chloride, that is, the efficiency with which it acts, the rapidity with which it causes the mud to settle, and the ease with which it can be handled owing to its solubility, make it ideal, and it is most desirable that it should be on the Australian market at as cheap a rate as possible. In Germany, it is advertised at about 2½d. per lb., and this price doubled would still leave it a cheap chemical for clearing water.

Chloride of iron is not merely harmless. It is more, it is a most valuable mineral constituent for all animals. There is consequently a distinct gain, even if too much is added to the water.

As previously mentioned, however, the added chemical (if not in larger quantity than required) is thrown out with the mud.

EXPERIMENTS ON A PRACTICAL SCALE WITH CHLORIDE OF IRON.

These consist of the clearing of large volumes of water (a) in iron tanks, (b) in the open field.

Tank Experiments.—A large cylindrical tank with height 7 feet, diameter 5 feet and 850 gallons calculated total capacity, was taken.

At 2 p.m. (20th April) a 1 lb. bottle of chloride of iron was opened and filled with water up to the neck. All the solid dissolved in this volume of water, and at 4.30 p.m. half the bottle was emptied into the tank which contained 600 gallons of muddy pond water. The water was stirred round with a short stick for half a minute in order to uniformly distribute the iron chloride solution.

Next morning, at 9 o'clock, water was drawn off from the bottom of the tank by the tap and syphon. It proved clear and clean. Thus, overnight, 600 gallons of dirty muddy water not fit for drinking, for use in the dairy, or the house, were converted into so much clean and attractive water of good bacterial purity and uncontaminated by any chemical. And this result was obtained by the use of only half a pound iron chloride without the need of any expensive plant, such as a large filter, or of any skilled labour.

A second experiment proved an equal success, and a description illustrates a further practical detail.

This time the tank was filled to its full capacity (850 gallons), and ½ lb. of iron chloride in solution stirred into the water at the top (2nd May, evening). Next morning, the water drawn off at the bottom still showed a slight opalescence, and had not the perfect cleanliness and brightness which it has when enough of the chemical is added. In consequence, a further ⅙th of a pound of dissolved chloride of iron was added, and the water again allowed a night in which to clear. The following morning, 4th May, the water drawn off proved perfect.

This experiment well illustrates how the addition of insufficient chemical in the first place can be rectified by a further small addition afterwards. In this way, just the right amount necessary can be added, and no waste occurs through adding too much.

It will be noted that in this experiment the precipitated mud had settled through 7 feet of water during the night. The actual deposit of mud was not more than half-an-inch in thickness.

The bacterial count of the water before treatment was 22,000 organisms per cubic centimetre. After treatment, the count was 240 per c. c.

Experiments on Open Dam Water.—A small water-hole, containing an estimated 1,000 gallons of a thick and dirty muddy water, situated on the property of Mr. Ross, of Deep Creek, Templestowe, was treated on the evening of the 2nd May, with 1lb. of iron chloride. The concentrated iron chloride solution was diluted, and just thrown out over the surface of the pond, keeping the distribution as uniform as possible. The water was not stirred at all, though it would have been more advisable to have stirred the surface layers, so as to ensure a regular distribution of the chemical.

Next morning, 3rd May, the water was clear, and every leaf and twig could be seen on the bottom of the tank.

A second experiment with a water-hole on the property of Mr. Neilson, Warrandyte, was equally successful. The water had a surface area estimated at 400 square feet, and an average depth of 9 inches. Capacity 1,800-1,900 gallons. At 4 p.m. on 7th May 2lb. of iron chloride in solution were thrown out as evenly as possible over the whole surface of the dam. With a long pole the surface layers were then gently stirred.

The water was next seen at 9 p.m., when it was perfectly clear and all the mud had settled out to the bottom. The bacterial

results with these waters were just as satisfactory as with the tank experiments. It should, however, be borne in mind that in clearing an open water hole a heavy rain may wash fresh mud in, and so undo all the good work accomplished.

CONCLUSIONS.

The chemical precipitation of the mud in storage tank waters has not been found to fail in a single instance, so that the method should be of general utility, no matter what is the geological nature of the country in which the water dam is situated.

In a country like Australia, where a clean supply is often not to be had, the case for a general use of chemical precipitation methods is a very strong one indeed.

Alum and lime are widely obtainable, but if arrangements can be made for a cheap supply, it is chloride of iron that is most strongly recommended. From what has already been said, it is apparent how easy and how eminently practical is its use.

If the water prior to treatment is from a doubtful source, such as a storage dam to which cattle have access, then it is recommended that it should be either filtered or boiled before being used as drinking water in the house. But if the water dam is in an enclosure and kept free from pollution by cattle, precipitation alone yields an excellent water.

It may further be added that, if desired, the flocculent mud could be separated by running the water through a centrifugal machine, after the addition of the chemical. This treatment, however, is hardly likely to be necessary, seeing that the precipitated mud will settle down through 7 feet of water in a single night by the ordinary force of gravity.

It is especially thought that clean waters so obtained should be valuable in butter factories and dairies, or for the use of steam-engines. Also, stock are the better for a supply of clean, than dirty water, and a liberal supply of clean water is often acceptable for domestic purposes.

It is for those who use, or would use, clean water if they could—butter factory managers, dairymen, stock-owners and others—to give precipitation methods a fair trial.

—A. C. H. Rothera, M.A., M.R.C.S. (Lecturer in Bio-Chemistry, Melbourne University, Victoria, Australia) in "The Journal of Department of Agriculture of Victoria"; Vol. VIII, Pt. 7. (July, 1910).

Forestry Officer's Reports

I.—CHRISTIANBURG LANDS.

The Christianburg lands may be taken as being fairly representative of the lands bordering the Demerara river in that locality the forest growth on which will be found very similar to that given in the following summary.

The botanical names are given only of those trees that have been identified with certainty.

Results of sections taken at Christianburg indicate the trees composing the forests at this place to be as follows :—

(1.) *Forest on slightly elevated hills of white sand* (as determined by sections taken at four different places some distance apart from each other).

	Name of Tree.	*Number per Acre.*	*Average Girths.*
(1.)	Soft Wallaba (*Eperua falcata* Aulb.)	37.5 trees	33.9 inches
(2.)	Ituri Wallaba (*Eperua Jenmani* Oliv.)	34.7 „	45.8 „
(3.)	Baramalli...	18.7 „	31.7 „
(4.)	Mora-balli	8.4 „	34.9 „
(5.)	Haiari-balli (brown var.)	6.6 „	80.9 „
„	Mora-bukia	6.6 „	50.7 „
(6.)	Kakaralli (*Lecythis* sp.) ...	4.7 „	41.6 „
(7.)	Black Kulishiri (*Tapira* sp.) ...	3.7 „	24.7 „
(8.)	Ichiki-bura-balli	2.8 „	38.8 „
„	Kakabashiru	2.8 „	26.7 „
„	Fotui or Phootee	2.8 „	34.5 „
„	Koro-koruru	2.8 „	85.5 „
(9.)	Duka	1.9 „	20.2 „
„	Trysil (*Pentaclethra filamentosa* Bth.)	1.9 „	34.5 „
„	Yekuru Silver-balli (*Nectandra* sp.)	1.9 „	
„	Manabadin	1.9 „	
„	Yellow Silver-balli (*Nectandra* sp.)	1.9 „	42.5 „
„	Determa	1.9 „	32.5 „
		143.5 „	

Only trees from 18 inches in girth upwards were reckoned in the sections, in which the total number per acre was found to be 162.5 trees. The remaining 19 trees per acre were made up of an equal number of different species, or about 1 tree per acre of the following 18 woods: Yaruru (*Aspidosperma excelsum* Bth.), Waimara, Hikuribiandra, Hiwaradanni or Noyeau, Kautaballi (*Licania mollis* Bth.), Dukalli, Shirabulla-balli, Maho, Sukune, Haimarakutchi, Ariwa, Yellow Silverballi (*Nectandra* sp.), Mabua (*Plumeria* sp), Akuri-bruit, Kairuballi, Arara, Konoku and Serabadanni.

2. *Forest on flat clay land* extending inwards from the bank of the river and above the level of high tides, cleared and cultivated about twenty-five or thirty years ago.

	Name of Tree.	*Number per Acre*	
(1)	Suradanni (*Hieronyma laxiflora*, Mull.)	15	Trees.
„	Keriti (*Ocotea* sp.)	...15	„
(2)	Buruma	...13.1	„
(3.)	Aliku Whiakey (*Inga* sp.) ...	...11.2	„
„	Pairuwa Whiakey (*Inga ingoides* Tul.)	...11.2	„
(4.)	Aramata (*Diplotropis brachypetala* Bth.)	... 7 5	„
„	Hurowassa (*Pithecolobium trapezifolium* Bth)	7.5	„
(5)	Shiberu Ahabu	... 5.6	„
(6.)	Corkwood (*Pterocarpus draco* Linn)	... 3 7	„
„	Maho (Broad Leaf) *Sterculia* sp. ...	... 3.7	„
„	Trysil (*Pentaclethra filamentosa* Bth.)	... 3.7	„
„	Kauta (*Licania* sp.)	... 3.7	„
„	Kakaru or Table Tree	... 3.7	„
		104 6	„

The mean of the girths of the abovementioned trees were :—

Smallest	24.3	inches.
Largest	36.1	„
Average	30.4	„

With few exceptions only trees over 20 inches in girth were counted, the total number per acre being 129.3 trees. The remaining 13 trees were all of different species of each of which the number per acre was about 1.9 or nearly 2 trees, or in all 24.7 trees per acre, having a mean girth of 30.4 inches.

In addition there were about 32 palm trees per acre nearly all Manicole (*Euterpe edulis*).

MAINAP OR SECOND GROWTH FOREST.

(3.) *On slightly elevated land of clay containing rocks and gravel of laterite* formerly partly cleared and cultivated by Indians.

	Name of Tree.	*Number per Acre.*	
(1)	Wakara-danni	...45	Trees.
„	Hurowassa (*Pithecolobium trapezifolium* Bth.)	45	„
(2.)	Wara-hia	. 37.5	„
(3.)	Kabukalli (*Goupia glabra* Aubl.) ...	...30	„
„	Shirida	...30	„
(4.)	Kautaballi (*Licania mollis* Benth.)	...15	„
		202.5	„

The mean of the girths of the abovementioned trees were :—

Smallest	14.3	inches.
Largest	30.9	„
Average	22.5	„

Of the 247.5 trees growing to the acre in the forest at this place in addition to the trees described above, the remaining 45 per acre consisted of six different species, viz, Trysil, Humara or Tonkin Bean (*Dipteryx odorata* Willd.), Sadaballi, Doro, Kadishiri and a Melastomacea, each equal in number, or 7.5 per acre, having an average girth of 29 inches.

Amongst the young trees not included there were 22.5 of greenheart growing to the acre

4. At a section taken in Wallaba Forest, aback near where charcoal had been burnt last, in July, 1899, the trees growing there were found to number 1,035 per acre. The soft Wallaba stumps indicated that the number of these trees cut at that time were about 90 trees per acre, and a similar number per acre of Ituri Wallaba trees were still standing varying from 13 inches to 73 inches in girth, the average girth being 38.6 inches. The young trees from 15 to 20 feet high and of slender girth numbered 855 per acre: of these the most numerous were Yekuru Silverballi with 517.5 trees per acre, and next in numerical order came Kumuna-balli, 157.5 per acre, Ituri Wallaba 135 per acre, and lastly Soft Wallaba as well as five other different species with 22.5 trees per acre each.

5. The trees forming one of the patches of forest growing in the Muri bush on sandy savannah lands aback consisted principally of:—

(1.) Kamakutshi	157.5 per acre
(producing silk cotton)	Average girth 16.5 inches.
(2.) Kakarawa	22.5 per acre.
	Average girth, 29.5 "
(3.) Muri Kautabali	22.5 per acre.
	Average girth, 18.5 "

The other trees were Bania, Yekuru Silver-balli, Hackia, Sibadanni, Hikuri-biandra, Bara-kara (*Ormosia coccinea*), and certain nameless trees. Of each of these they were 11.25 trees per acre, having an average girth of about 25 inches, the total number of trees being 281.25 per acre.

C. WILGRESS ANDERSON,
Forestry Officer

Malaria and Labour.

"On banana and sugar estates (in Jamaica) the loss of time through illness, mainly malarial and therefore preventable, amounted to 16 out of every 100 working days." This means a loss, that could be prevented, of nearly 17 per cent. in the available labour supply, plus (in the case of indentured coolies) the cost of maintaining the patients in hospital whilst laid up.

W. T. Prout, C.M.G., M.B., C.M., in "The Prevention of Malaria" by Ronald Ross; quoted by "Tropical Life," October, 1910.

Hatching Turkey Eggs.

Set turkey eggs under a gentle chicken hen. Three days before hatching put eggs in a basin half full of good warm water, or enough so that the eggs will float, and you will be able to tell every egg that will hatch. You can notice them move slightly, and next morning and third morning the little turks will be so strong they will sometimes pip the egg in the water, but always above the water. So do not be afraid to test the eggs in this way.

Natal Agricultural Journal, September, 1910.

Estate Sanitation.

In the Volunteer Drill Hall, Singapore, Dr. Brooke, Port Health Officer, gave an interesting lecture on estate sanitation dealing, as he said, not with technical hospital points or treatment of the sick but with a general consideration of the surroundings of the coolies and the circumstances leading to common illnesses. In the first place they had to consider the dwelling and had to remember that the air was always full of floating dust and dirt which were the carrying media of countless germs of all sorts. The majority of these settled in time on the floor, some stuck to the walls and some rose to the ceilings. Therefore the important point to deal with was the floor and the worst type of floor they could have was the sand floor which soaked up and retained all the germs without possibility of cleansing. Then came the wood floor, which was not much better. The best form of floor was a concrete floor with well smoothed surface raised along the middle and graded to the sides. The walls should be discontinued about two inches from the ground so that the floor could be thoroughly swilled over without obstruction where the walls reached it. As to the walls. they were not so important, but care must be taken. If of wood the wood must be well dressed, as smooth as possible, and should be white-washed about three times a year, a disinfectant being worked into the white-wash. The same remarks applied to ceilings. Iron of course was the best for the walls and roof from a sanitary point of view.

As to ventilation the great thing was to secure, if there were doors and windows, that they were kept properly opened. In that part of the world it was not difficult to arrange for thorough ventilation.

VENTILATION.

The great thing in all ventilation was a free play of fresh air and sunlight into all buildings. In order to help to ensure this, the jungle (bush) near buildings should be cut away sufficiently from the lines, because if it was not there was sure to be dampness, darkness and stale air, splendid media for the breeding of flies and other objectionable conditions. Drains should be well cut and kept clean, and water should not be allowed to settle and remain in them. Turning to mosquitoes the lecturer mentioned that so important was reckoned the part the mosquito played in illness that in some West Indian islands it was now a punishable offence to have any larvæ of them on the premises. They, must also war against flies, and cleanliness

was one of the greatest of foes to the fly. Flies and bluebottles were perhaps the most dangerous of all disease spreading agencies. They bred at all times, throughout the year, though there were four main seasons. The eggs were laid in decomposing matter either animal or vegetable and in a few days the larvæ appeared as maggots feeding on the surroundings. These in time became flies. The great danger of flies to human beings was that they were omnivorous feeders, and whilst preferring filth would alight and feed on any food. There was little doubt that dysentery, enteric, and cholera were in a very large number of cases transmitted by flies first feeding on infected filth and then alighting on human food or in such way conveying the infection to human beings. Therefore they must take care that night-soil and refuse matter of all descriptions was not allowed to lie about.

DISPOSAL OF SEWAGE.

The question of disposal of such refuse then came in. It was known that for about three feet down in the soil there were certain organisms which did not exist at a lower level; which when things were buried in that three feet acted quickly in the decomposing of the substance buried, thus returning it to its constituent parts. If buried lower, these agencies did not act nearly so quickly. So it came about that the best refuse and other arrangements for armies, coolies and other large bodies of persons, were shallow pits about three feet deep. These should be screened with kajang, and fresh earth should be thrown in until about a foot from the top, when the trench should be filled in and fresh ones dug. In certain seasons it might be advisable to add some quick-lime with the earth, but it was not necessarily a desirable thing to do that always. Such pits must of course be away from possibility of contaminating the water supply, or of the drainage from them percolating into any part of the camp where it could be injurious. As to water if it were collected off iron or tiles it should be pretty right and the great point in any case was to remember that it should be kept in such a receiver that it would be impossible for coolies to dip into it with their vessels. It should only be available through a tap or other such means. If the roofs were of attap, then it was better to rely on wells. Wells were dug either shallow or deep. If shallow they merely penetrated the subsoil water Under those circumstances it would be seen that such wells must be rendered absolutely secure from any possible contamination by percolation, etc, from any latrine or refuse arrangements on the estate. If deep wells were sunk the well would go through the first impermeable layer to the second. It would draw on a larger supply of water and would not be liable to the contamin-

ation objection as long as great care was taken to face the sides of the well thoroughly satisfactorily, so that the subsoil water could not drain into it.

In that case they would have a well penetrating the subsoil water but draining its water supplies from an area between the two impermeable surfaces. Turning more particularly to disease, the three most common they had to face were

MALARIA, ANKYLOSTOMIASIS AND BERI-BERI.

Dealing with the first, Dr. Brooke gave a clear demonstration of the life cycle of the infection parasite in the human and in the mosquito host. Continuing, he said coolies arriving on estates often came with malaria and should be examined and treated if necessary. He proceeded to describe the *Anopheles* or malaria species of mosquito, pointing out that it could be distinguished by the fact that its larvæ rose to the water parallel to the surface instead of at an acute angle as in the case of the ordinary mosquito. Then again the *Anopheles*, in popular words, when sitting down looked as if trying to stand on its head, and in some cases a good guide was its having spotted wings. The *Anopheles* was the variety which spread malaria, and it was the female who was the bloodsucker. Generally they were night-feeders. And in regard to that he would like to tell them that a mosquito curtain pulled tight round the bed against which they might put an arm or leg and so give the mosquito a chance to bite through the netting was no use at all. It should be arranged so as to prevent that possibility. The *Anopheles* had a preference for breeding in water which was likely to be undisturbed, and that was one of the reasons why railway and other opening works were accompanied by so much sickness; because large pits and places were left which filled with water and became stagnant breeding grounds. It required very careful attention to get rid of them, but it could be done by painstaking and careful work. The great remedy in fever was quinine which was a direct poison to the parasite and its destructive effect could be easily and plainly demonstrated.

Turning then to ankylostomiasis, the doctor said that this was the infection of the intestinal canal by a small worm which fastened on the side walls of the intestine and sucked the blood. The irritation caused by the action induced a greater flow of blood to the spot and this increased the mischief. In cases where these parasites existed in great numbers they were a great danger. The coolie became listless, anæmic, and had digestive troubles, and would in time die if not cured. This disease was

communicable not only by ingestion through fresh vegetable food etc., but (it was now found) the worm actually

PENETRATED THE PORES OF THE SKIN

and in time reached the intestines. It would be seen, remembering the dirty habit of coolies and where they walked, that every circumstance was favourable to their getting this illness. The disease if suspected could be discovered by examination of the stools, and should be treated at once. Beri-beri was sometimes a trouble to them and was supposed at present to be due to overpolished rice. In the cure the diet should be generous and varied, and parboiled rice should be given. They sometimes met cholera and smallpox. As to the former it could only be contracted by entry through the mouth. It could not be taken in with the air of a room. In all cases immediate and thorough disinfection of the place where the coolies had been vomiting and purging should take place and the man removed. This was the primal and most important point, the disinfection of the area occupied by the coolie. Nor could cholera be taken in through wounds. Afterwards the water supply must be immediately looked to, plenty of disinfectants used and good food and water supplied. As to smallpox, they must remember it was carried in the air and they must in disinfection therefore take care to disinfect not only the place occupied but the whole area of the barracks above and below. Coolies should be vaccinated.

The doctor then proceeded to give some valuable hints, as to

DISINFECTANTS,

putting formalin first on account of its bactericidal properties, its possibility of use either as liquid or gas, and its non-spoiling properties. He also referred to the coal tar series of disinfectants The coal-tar disinfectants he remarked were mostly of one type, —a mixture of cresol with a liquid soap. Jeyes' Fluid was an example. They all formed a milky white emulsion when mixed with water. Their emulsion was spoilt, however, when they came in contact with chlorides : consequently they could not be mixed with sea water and their disinfecting power was impaired when used to treat urine, etc. A better type of coal-tar disinfectant was represented by Izal or by Sanitas-Okol, both of which were already emulsified, and whose power was unimpaired by any mixture of water or liquids containing chlorides. Sanitas-Okol, being of a stronger germicidal value than Izal, could consequently be used in greater dilution and was therefore cheaper.

—"The Straits Times": August 19, 1910.

"Witch-Broom" Disease in Wild Cacao.

The very diligent manager of the mines of the Compagnie des Mines d'Or de la Guyane Neerlandaise, Mr. Despaux, sent me (Dr. C. J. J. van Hall) in March, 1907, some fruits of a wild growing cacao species, which was not rare in the forests of the far south of Suriname. The Indians, Mr. Despaux told me, like the sour-sweet juice which surrounds the seeds.

The fruits of this wild cacao are yellowish-brown and smaller than those of the ordinary cacao, being 8 to 12 cm. long and 6 to 8 cm. in diameter. They have five prominent ridges. The parts between the ridges are rather smooth, at any rate not warty. The fruits have some 20 round seeds, which do not contain theobromine, according to the analysis of Dr. Sack, Government Analyst.

The seedlings obtained from these seeds turned out to be very weak. The climate or soil of the north of Suriname seems to be unsuitable for this plant which grows wild in the south of the colony. One after the other died and after half a year only one plant was still alive, namely on the plantation "Vriendsbeleid" (a few plants had been given to some planters, who were curious to know this new Theobroma).

This plant kept living for one year more, and having attained a height of about one meter it trifurcated into three branches as the ordinary cacao does. At this stadium it began to get yellowish and weak, but before dying it made to our great surprise a big "krulloot" just under the trifurcation.

In the meantime Mr. Despaux had sent us leaves and also flowers, which he had obtained with much difficulty from the Indians. They were sent to Dr. Pulle in Utrecht, who recognised the plant as *Theobroma speciosum*, Spreng. a species known up till now only from the Amazon basin and from French Guiana.

Mr. Despaux sent us again, on our request, a number of fruits, which arrived on the 29th of March, 1909, in very good condition, at the Garden in Paramaribo. We obtained from them some 200 plants, which were put in bamboo pots and placed in the nursery of the Garden.

When they were about 10 to 15 cm. high, we found that the stems of some of the plants were swollen at the top, the well-known symptom of the disease. A close inspection proved

that not less than 32 plants were attacked in this way. The mycelium of the *Colletotrichum luxificum* was found easily on microscopical examination.

That such a great number of plants of *Theobroma speciosum* should be attacked (32 out of 200) was the more striking, because next to them in the nursery stood about a thousand plants of the ordinary cacao of the same age and size, and of these only five plants were attacked.

This points to the fact that the wild *Theobroma speciosum* is still more liable to the disease than the ordinary cacao (*Theobroma Cacao.*) And this view is supported by the information of Mr. Despaux that the tree which he saw in the forest had a great number of dead and diseased twigs, and made in every sense an impression of being sick.

Having these observations in mind the supposition is allowable that this wild cacao has been already suffering from the disease for many years and it is not improbable that the cultivated cacao got the disease from the wild one. If this is so, it is no longer to be wondered that in the district of Nickerie the disease appeared first in the plantations situated high up the river and spread towards the coast.

And finally one observation may be a warning to the neighbouring country of Surinam—Brazil—which has also *Theobroma speciosum* growing wild in the forests. Perhaps in Brazil also this wild cacao is covered with " krulloten " and perhaps the parasite is only waiting a good occasion to attack the cultivated cacao there also.

Dr. C. J. J. van Hall in " Proceedings of the Agricultural Society of Trinidad and Tobago," October, 1910.

Earthworms.

(Earth) Worms seem to be the great promoters of vegetation, which would proceed but lamely without them, by boring, perforating and loosening the soil, and rendering it pervious to rains and the fibres (roots) of plants, by drawing straws and stalks of leaves and twigs into it; and most of all, by throwing up such infinite numbers of lumps of earth called worm-casts, which, being their excrement, is a fine manure for grain and grass····the earth without worms would soon become cold, hardbound, and void of fermentation, and consequently sterile.

Gilbert White : "Letters."

The Double Coconut *(Lodoicea (sechellarum) callipyge.)*

Amongst the interesting plants collected together in the Botanic Gardens, the double coconuts that are growing along the calabash avenue are well worth a visit. The double coconut (*Lodoicea (sechellarum) callipyge*) is found on two or three of the small rocky islands of the Seychelles. In 1743, La Bourdonnaise found the tree on the island of Praslin, but the nuts had been found floating in the Indian ocean on many occasions in the 16th and 17th centuries. In the early days the nuts fetched fabulous prices, and were believed by both European and Asiatic physicians to have marvellous medicinal properties.

It is generally stated that this beautiful palm takes a long time to come to maturity. It is said to take at least thirty years before it flowers, and to attain its full growth when 150 years of age. The fruits are supposed to take ten years to mature, and when they are almost four years old the nuts are said to be edible, but when mature the albumen hardens almost to the density of ivory. The trees grow to a height of 100 feet, and the fruits may weigh from 20-40 lbs. each.

The trees are separately male and female, the males producing spadices up to 3 feet in length and 3 inches in diameter, while the females produce from four to eleven flowers set on zig-zag stalks.

Two of these palms in the Botanic Gardens have flowered, One—a female—first flowered when it was just over twelve years of age, while the other—a male—flowered when about fourteen and a half years old. A fertilized fruit was obtained by hand pollination in 1909, while two other female flowers have recently been fertilized. Unfortunately, the first fruit has been slightly injured during weeding operations, but it is hoped that it may properly mature. What is now being awaited with interest is the time that will be required for it to ripen. If fruit has been obtained from these plants in sixteen years perhaps the generally accepted idea of ten years being required for the fruit to ripen may not hold in the case of the plant in these Gardens.

THE PLANTS IN THE BOTANIC GARDENS.

In 1886, two seeds of the double coconut were procured through the Mauritius Government from the Seychelles. One weighed on arrival 25 lbs. while the other scaled 22 lbs. The seeds were carefully planted but did not grow. In 1893

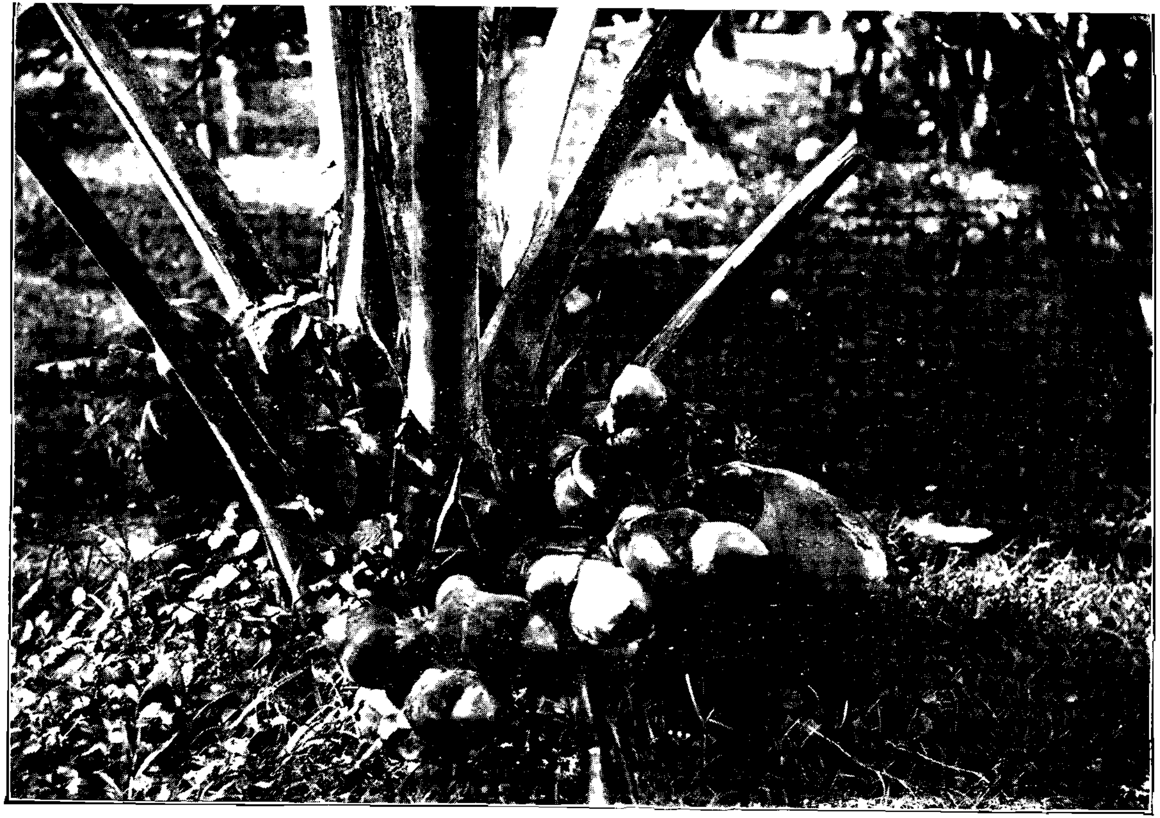

Plate 1.—DOUBLE COCONUT IN BOTANIC GARDENS, BRITISH GUIANA.

Female plant at 16 years of age showing first fruit.

(*Block kindly lent by His Majesty's Stationery Office.*)

another consignment of twelve nuts was procured by Mr. Jenman from the Commissioner of the Seychelles. They were packed in teak cases in sawdust. Eight had germinated *en route*, but either from exposure to cold while passing through England in winter or from being packed in dry sawdust, they were all dead. The four nuts that had not germinated *en route* did not grow. Later in the same year, however, another consignment was obtained in damp packing material. Mr. Jenman, in his report on the Botanic Gardens for 1893-4, states *inter alia*: "Four of these (seeds) had germinated on the journey and were planted out on prepared sites in a carefully selected situation. One of these has now a fully expanded leaf five feet high and nearly as wide....The nuts unsprouted on arrival were laid in a bed of damp coconut fibre refuse, on a bench in the propagating house, and when examined at the end of three months five were found germinated and were planted out. One of the other three has since germinated, and two so far have not, and must be regarded as having failed. So that out of the twelve nuts ten germinated, eight of which have succeeded, and have the first leaf either expanded or partially open. The period required for germination seems to be from two to six months and about the same varying time further for the spike-like sheath originating in the embryo to appear above the ground. This time depends greatly on the direction the radicle, which contains the germ at its outer end, turns to grow. In most of these cases it kept near the surface, but in two it went down quite vertically under the nut a foot and a half or more, and these two (plants) took several months longer to appear above the ground than the others, but with the leaf ready to burst as soon as the point of the sheath emerged through the surface, while in those that the germ burst out near the sufface the sheath grew to 12 or 14 inches long before it opened by the pressure of the developing first leaf."

In 1894-5 it was reported that three of the most vigorous plants had died owing to unsatisfactory soil conditions. It was noted that it took a year to produce each leaf, and that it took one of the nuts over three years before the point of the spike-like sheath appeared through the surface of the ground. It was generally thought that the end of the radicle, which contains the germ, after the emergence of the latter, formed a perforated socket in which the stem of the developing plant stood, being permanent as the tree itself and developing in size as the tree developed, the roots passing down into the ground through the perforations, but Mr. Jenman had one of the plants that died carefully dug up, and found that "as the germ (shoot) starts from the point of the radicle so the first

roots start from its base......the radicle from which they emerged eventually disappearing in time, having completed its functions."

In the following year, five other plants died, and three had not shown through the surface of the ground. Eight plants were still alive and appeared to be healthy. In 1898–9 two died, thus leaving six still alive. One of these plants subsequently died, and in 1906, when the first one flowered, five were still living. Since then another has died, leaving four plants. One of these, however, has only one leaf remaining and will shortly die.

FLOWERING OF THE PLANTS.

Of three plants growing along the Calabash avenue two have flowered. Of these, one is a male plant and the other a female. The female plant first flowered in March, 1906, when it was just twelve years of age, while the male plant produced its first spadix during June, 1908.

The following details of the flowering of these two plants are of considerable interest:—

The female plant has produced nine spadices. The first was produced in March, 1906, and consisted of 7 flowers, but none of these were fertilized as pollen was not available. This first spadix has fallen. The second contained five flowers, but again it was not possible to fertilize them. The third spadix was produced towards the end of 1907 and contained two flowers, one of which became somewhat swollen. The fourth spadix produced two flowers, the fruit of one of which grew to 10½ inches in length although it was not pollinated. The fifth spadix produced in 1908 had seven flowers which were pollinated by the Head Gardener late in that year. One of the flowers became fertilized and a well-formed fruit, as shown in the illustration, which has been prepared from a photograph by the Assistant Analyst, is being produced. It now measures 17 inches long and 36 inches at its greatest circumference. Another fruit on this spadix has elongated to 12 inches in length but it apparently is unfertilized. The sixth spadix was produced in 1909 and had six flowers. None of these became fertilized. The seventh spadix was abortive and the eighth produced five flowers which were pollinated in May, 1910.

Two more fruits are being produced, one of which now measures 10½ inches in length and 23½ inches in circumference. The ninth spadix has just been produced and the flowers were pollinated towards the end of November.

Plate 2.—DOUBLE COCONUT IN BOTANIC GARDENS, BRITISH GUIANA.
Male plant at 16 years of age showing fourth spadix.
(Block kindly lent by His Majesty's Stationery Office.)

This plant has now fourteen well-formed leaves and three have died. Thus in 16½ years, this plant has sent up 17 leaves.

The male plant has produced 13 leaves and has flowered as follows:—

June, 1908—First spadix.

Feb., 1909—Second spadix—24 inches long and 3 inches in diameter.

May, 1909—Third spadix—This was broken off.

Feb. 1910—Fourth spadix—29 inches long and 3¾ inches in diameter. Completed flowering in July. (Photographed in February, see illustration).

July, 1910—Fifth spadix—Flowers commenced to obtrude in October.

The third plant has not yet flowered. It has produced 13 leaves in 16½ years, and they are larger and much more handsome than those of the other plants.

PRESERVATION.

The Linnean Society some time ago took steps to have this palm preserved in the Seychelles as there was a danger of its extinction, and therefore the possibility of raising mature fruit in the Botanic Gardens of this colony is of the greatest botanical interest. It is, we believe, the first occasion on which fruits of this palm have been produced in the Western Hemisphere, and the production of fruit at 16 years of age is certainly remarkable as it is generally believed that in the Seychelles no plants flower until they have reached 30 years of age.

Through the courtesy of the Director of the Royal Botanic Gardens, Kew, who has taken a considerable interest in these palms, we are able to reproduce in this number of *The Journal* illustrations showing the two plants that have flowered in British Guiana. The blocks for these illustrations were prepared from photographs taken by the Assistant Analyst (Mr. J. Williams) and have kindly been lent to the Department of Science and Agriculture by His Majesty's Stationery Office.

F. A. STOCKDALE,

J. F. WABY.

The Canadian Exhibitions.

SUCCESS OF BRITISH GUIANA EXHIBITORS.

The following extracts from a letter from Messrs. Pickford & Black having reference to the colony's exhibits at the Exhibition held in Canada at Toronto and St. John during August and September, 1910, have, by direction of His Excellency the Governor, been published for general information.

TORONTO.

"We think that the exhibits from Demerara looked very well and should do a lot of good. Woods, together with all other exhibits, with the exception of confectionery, have been handed to the Provincial Museum at Toronto. We allowed three samples of your sugar to go to the Guelph Agricultural College.

"We succeeded in getting the following awards at Toronto:—

Gold Medal—Permanent Exhibitions Committee, for General Exhibit.
Gold Medal and Diploma—Hon. B. Howell Jones, for sugars.
Silver Medal and Diploma—T. Earle, Esq., for cacao.
Silver Medal and Diploma—Colonial Chocolate and Confectionery Co., for confectionery.
Diploma—Messrs. Sprostons, Ltd., for greenheart.
,, —The Consolidated Rubber & Balata Estates, Ltd., for balata.
,, —Demerara Development Co., for citrate of lime.
,, —Messrs. Sandbach, Parker & Co., for general exhibits.
,, —Messrs. Wieting & Richter, Ltd., for rice & sugar.
,, —New Colonial Co., Ltd., for sugar.
,, —Messrs. Booker Bros., McConnell & Co., Ltd., for molascuit.

ST. JOHN.

"The St. John exhibit looked very well, but space was limited. We have delivered to the Museum at St. John all samples of wood, and are returning the balance of the exhibits, with the exception of the samples given away, to you, as we did not think it advisable to pass the balance of your exhibits to any of the museums in that city.

Yours truly,

PICKFORD & BLACK,
per C. S. PICKFORD.

The Crops on the Experimental Cane Fields: October-December, 1910.

The crops grown on the Experimental Cane Fields were reaped in the autumn of this year (1910) with the general results shown in the following notes :—

AVERAGE YIELDS OF VARIETIES.

On the Experimental fields this year some Bourbon canes were grown on lands which had not been occupied by sugar cane since the Botanic Gardens were established. The yields of these Bourbon canes may be conveniently taken as the standard yields with which to compare the yields of the other varieties. The average yields under the various conditions of manuring used in the large plot series of trials were as follows :—

CANE					JUICE.	SACCHAROSE.	
Variety	*Parent*	*Plants or Ratoons*	*Tons Canes per Acre*	*Per cent. of Canes*	*Specific Gravity*	*Lbs. per gallon*	*Tons per Acre*
*118	D 625	Plants	53.7	65.5	1.076	1.844	6.03
†625	Dyer	Ratoons	45.9	69.7	1.072	1.668	4.98
*625	Dyer	,,	38.4	69.	1.0715	1.656	4.09
*419	D 625	,,	32.9	67.	1.079	1.889	3.85
†216	Bourbon	,,	35.8	66.9	1.073	16.42	3.65
*642	,,	Plants	33.2	66.7	1.0685	1.607	3.32
†294	,,	Ratoons	30.6	69.	1.072	16.89	3.32
†504	D 145	,,	29.6	69.9	1.075	1.700	3.27
*398	D 95	,,	28.3	64.1	1.081	1.875	3.14
*405	D 625	Plants	31.7	62.6	1.068	1.638	3.04
*338	Bourbon	,,	29.9	69.1	1.0647	1.525	2.96
† 60	D 95	Ratoons	27.7	61.5	1.077	1.833	2.90
*420	D 625	,,	28.9	65.3	1.069	1.615	2.85
†281	Bourbon	,,	27.4	69.9	1.070	1.586	2.83
†357	D 115	,,	26.	69.	1.075	1.692	2.82
*167	D 625	Plants	24.4	70.7	1.075	1.763	2.82
*145	Red Ribbon	,,	24 8	68.2	1.074	1.735	2.73
*433	1087	Ratoons	26.4	63.7	1 0746	1.739	2.72
*Bourbon	——	Plants	24.8	68.9	1.071	1.667	2.66

Nos. 366, 4,399, 4,395, 23, 24, 177, 4, 44, 448, 638, 4,397, 208 B, 358, 4,407, 99, 14 and 13 gave returns which compared unfavourably with those of the standard Bourbon, although Nos. 366,

* Rows 6 feet apart.
† ,, 5 ,, ,,

4,399, 4,395, 23, 24, 177, 4 and 44 gave higher returns than did the Bourbon on land long and continuously under cultivation with that variety.

Planters perhaps will be more directly interested in the relative returns o the more satisfactory varieties under what may be considered as the normal nitrogenous manuring in British Guiana: 300 lbs. of sulphate of ammonia per acre :—

			PER ACRE.	
Variety.	*Parent.*	*Plants or Ratoons.*	*Tons of Canes.*	*Tons of Saccharose in expressed Juice.*
118	D 625	Plants	57.	6.26
625	Dyer	Ratoons	50.8	5.35
419	D 625	Ratoons	42.	4.73
642	Bourbon	Plants	46.3	4.73
625	Dyer	Ratoons	39.7	4.33
167	D 625	Plants	35.1	4.29
216	Bou bon	Ratoons	39.7	3.89
338	Bourbon	,,	38.3	3.36
398	D 95	,,	30.4	3.35
420	D 625	,,	31.9	3.19
281	Bourbon	,,	30.2	3,06
504	D 145	,,	27.6	2.95
405	D 625	Plants	32.6	2.90
60	D 95	Ratoons	26.2	2.90
294	Bourbon	,,	29.5	2.86
Bourbon		Plants	25.6	2.86
357	D 115	Ratoons	27.5	2.78
433	D 1087	,,	28.5	2 68
208 B			19.2	2.49
145	Red Ribbon	Plants	22.2	2.48

The most interesting features of the year are the large field yield and the high sugar contents of the juice of 118, a seedling of D 625, and the markedly higher average yields of the latter cane where planted on somewhat the poorer land in rows 5 feet apart than where planted on better land in rows 6 feet apart, the closer planting having resulted in an excess yield of 7½ more tons of canes with .89 tons of indicated saccharose in their expressed juice.

ROTATION OF VARIETIES.

A new series of plots were laid down for the further investigation of this problem. As in other years with *plant* canes the differences between Bourbon canes grown after Bourbon canes and

Bourbon canes grown after other varieties were not very marked. The following are the results obtained in this series :—

	Tons of canes per acre.
Bourbon after Bourbon	18.6
Bourbon after D. 2,468	19.9
Bourbon on the same land as the above but which had not previously been under canes	24.8

These results point to the alleged deterioration of the Bourbon cane being possibly due more to induced defects in the soil than to the degeneration of the variety.

EFFECTS OF MANURING.

With very few exceptions the beneficial effects of nitrogenous manurings were clearly apparent with all the varieties under trial. The mean returns with normal and high manurings (300 and 450 lbs. of sulphate of ammonia respectively) were as follows :—

		TONS CANES PER ACRE.		
Fields.	*Canes.*	*No Nitrogen.*	*Normal Nitrogen.*	*High Nitrogen.*
South	Plants	14.7	23.9	30.4
,,	Ratoons	20.3	29 7	35.1
North East	Plants	32.7	39.1	40.2
,, ,,	Ratoons	20.5	25.3	25.
North West	Plants	21.8	35.0	..
Mean		22.0	30.6	32.7

VARIOUS SOURCES OF NITROGEN.

Comparisons of the action of nitrate of soda and of sulphate of ammonia applied in equivalent proportions of nitrogen (60 lbs. per acre) gave the following mean results :—

	TONS OF CANES PER ACRE		
Fields.	*No Nitrogen.*	*Nitrate of Soda.*	*Sulphate of Ammonia.*
South	16.2	16.3	21.0
North East	15.4	21.2	24.8

Comparisons were also obtained on the relative actions of nitrate of soda and of sulphate of ammonia on soil continuously

manured with these substances. The mean results are shown in the following :

	TONS OF CANES PER ACRE.	
	After Nitrate of Soda.	*After Sulphate of Ammonia.*
Nitrate of soda	17.0	16.3
Sulphate of Ammonia	20.3	21.6

These comparisons are not satisfactory owing to the uniform failure of manurings with nitrate of soda to produce appreciably increased yields on the South field. This was doubtless due to the very unfavourable weather conditions which existed for some time after the applications of the manures.

Comparisons of sulphate of ammonia, nitrate of soda, nitrate of lime, nitrolim (calcium cyanamide) and dried blood as sources of nitrogen when applied in repeated dressings and in proportions in each case equivalent to 60 lbs. of nitrogen per acre were made on the North West field with the following mean results :—

TONS OF CANES PER ACRE.

No Nitrogen.	*Sulphate of Ammonia.*	*Nitrate of Soda.*	*Nitrate of Lime.*	*Nitro-lim.*	*Dried blood.*
21.8	35.	27.4	29.8	27.9	26.2

These comparative trials have been made during one year only—a year the meteorological conditions of which were unfavourable for the action of the nitrates, whilst possibly the constant state of saturation of the soil for some months after the application of the manures acted adversely on the dressings of nitrolim and dried blood.

DANGERS OF NITRATES.

The unfavourable results obtained in 1909-10 with nitrates, both where applied in single dressings and in repeated applications, should give pause to planters contemplating the substitution of nitrates for sulphate of ammonia in the manurings of their cane fields. Over a quarter of a century's experience in comparative trials with nitrate of soda and with sulphate of ammonia has shown to us that in normal years manurings of about 2 cwt. of sulphate of ammonia and of 2½ cwt. of nitrate of soda give very similar increases, that where heavier applications are made the action of nitrate of soda is uncertain and usually less favourable than that of sulphate of ammonia, and that in years of excessive or even heavy rainfall the beneficial effects of nitrate of soda, even in light applications, may fall far below those of sulphate of ammonia.

Another important point to be borne in mind when considering the advisability of the substitution of nitrate of soda for sulphate of ammonia is the very unfavourable effect of the former on the tilth of heavy clay soils. Repeated heavy dressings of nitrate of soda may so injure the condition of heavy clay soils for sugar cane cultivation that years may elapse before they return to their normal conditions of productiveness for that crop. This may not, and probably will not, result from repeated applications of nitrate of lime, but reliable data are not yet available.

For some years past data have been accumulating pointing to a possible injurious action of any excess of soluble salts in the manures applied to cane cultivation on heavy clay soils. In connection with this the following mean results of trials of sulphate of ammonia without and with sulphate of potash and superphosphate of lime may be of interest :—

TONS OF CANES PER ACRE.

		SULPHATE OF AMMONIA.					
	No Nitrogen.	*200 lbs. Yields.*	*Increase by Nitrogen.*	*400 lbs. Yields.*	*Increase by Nitrogen.*	*500 lbs. Yields.*	*Increase by Nitrogen.*
Without Potash and Sulphates	14.7	20.2	5.5	26.8	12.1	31.7	17.0
With Potash and Sulphates	16.2	18.7	2.5	28.4	12.2	31.2	15.0

Little, if any advantage, has on the whole been gained by the addition of the sulphate of potash and superphosphate of lime to the manurings with sulphate of ammonia. The fact that with dressings of sulphate of ammonia in the relatively low proportion of 200 lbs. per acre, the yields with sulphate of ammonia alone have been higher than with potash and phosphates in addition to it, is significant.

EFFECTS OF MANURING WITH PHOSPHATES.

A very large number of comparative trials with and without superphosphate of lime were made. The mean results were as follows :—

	TONS OF CANES PER ACRE.	
Fields.	*Without Superphosphate.*	*With Superphosphate.*
South	27.6	29.0
North	24.2	25.2

The increases due to addition of superphosphate to the manurings were not remunerative

EFFECTS OF THE APPLICATION OF LIME MADE IN 1891.

The effects of the heavy dressings of lime applied in 1891, which were very marked for many years after, are now exhausted; the total weights of canes cut from 49 plots with and without lime being

49 not limed plots	.. ..	38,591 lbs.
49 limed plots	.. ..	38,783 ,,

The effects of the liming were apparent for seventeen years, covering fourteen crops.

J. B. HARRISON.

F. A STOCKDALE.

Mustard for Fowls.

At the recent Royal Show in England, the Editor of *Monthly Hints on Poultry* had a conversation on the subject of the mustard test with the successful Orpington and Wyandotte fancier, Mr. H. Fildes, of Mobberley, Cheshire. Having been for years an advocate and user of mustard for poultry, he was asked to write his experience of its action for publication in *Monthly Hints*. His testimony is as follows:—"With regard to our conversation about mustard feeding, I may say that I have used it largely for winter feeding during the last fifteen years or so. My attention was drawn to it by the avidity with which the hens devoured the table scraps with mustard on them. I gave them more, and found a decided increase in the number of eggs, and as the fowls set aside for winter laying are the culls from my exhibition stock I do not consider the effect on their health so long as I get plenty of eggs, but I can certainly say that I have not had one case of ill-health that could be traced to the mustard feeding (and I have used it freely). What the after effects might be I am unable to say, as I always sell out this portion of my stock to the Jew dealers before Easter, but they have invariably been plump and made a good price. The breeding pens I do not stimulate at all, as I prefer fewer eggs and less risk of infertility. Though I do not wish to infer that mustard might not answer here also, I simply have not tried it. In conclusion, let me say that if I were a 'utility man' solely I would use mustard in very considerable quantities."

Editorial Notes in "Natal Agric. Journal," Sept., 1910.

Hints, Scientific and Practical.

Drainage for Rubber. The question of drainage for rubber has been overlooked in the whole of Mexico. Most planters claim that it is sufficient to have what is called "a good natural drainage." This is a mistake. The Eastern planter has fully realized this, and even on very sloping lands drains are made before the rubber is planted. I do not remember having seen a single rubber plantation in the East, where this was not done. The object of draining is not only to provide an outlet for the surface water, but to drain the ground down to a certain depth.

Pehr Olsson-Seffer, Ph.D. : in "Rubber in Mexico": (American Review of Trop. Agriculture, Vol. I, Nos. 5-6.)

Earthworms and their Work. Earthworms do not appear to have any marked direct effect on the production of plant food. Organic matter seems to decompose with formation of nitrates equally quickly whether they are present or not.

They are rich in nitrogen, containing about 1.5 to 2 per cent. and they decompose rapidly and completely ; thus they furnish a certain amount of plant food to the soil when they die.

Their chief work is to act as cultivators, loosening and mulching the soil, facilitating aeration and drainage by their burrows.

E. J. Russell, D. Sc. in "The Effect of Earthworms on Soil Productiveness" (The Journal of Agricultural Science, September, 1910).

Primary and Secondary Growth. In Science Progress, April, 1910, Parkin suggests that the reason why rubber from young trees is weaker than rubber from older trees may be due to the fact that the former may contain a large proportion of rubber formed in "primary growth," and that this rubber may be weaker than that formed in "secondary growth." "In such young trees the primary laticiferous tubes will still be yielding some latex which will mingle with that from the secondary tubes, giving an intermediate product." For the non-botanical reader, some explanation is probably necessary for the proper understanding of the terms used. In the life of every dicotyledonous plant there is a stage in which the cambium and bast are not arranged

in concentric cylinders round the wood, as in the usual Hevea stem. In that stage the stem contains a number of separate longitudinal strands, the vascular bundles, each of which consists of 3 longitudinal strands of wood, cambium, and bast respectively. This is the stage of primary growth. In some plants it persists throughout their whole life, but in the case of Hevea and similar trees another stage soon sets in. The cambiums of the separate vascular bundles unite into a complete cylinder, and this cylinder proceeds to form wood on its inner side and cortex on its outer side, for the rest of its life. When this happens the stem has reached the stage of secondary growth. It will be understood from this that secondary growth has commenced whenever the stem possesses a complete cylinder of wood. As far as the cortex is concerned, it is in its primary growth so long as it is green, but when it turns brown secondary growth has set in. It may be noted in passing that the arrangement of the latex vessels in the stem during "primary growth" differs from that which occurs during "secondary growth." In the former stage, the latex vessels may be found between the vascular bundles and in the pith ; but after a complete cylinderof wood has been formed, these inner latex vessels dry up, and subsequently latex vessels occur only in the cortex.

T. Petch. B.A., B.Sc. (Government Mycologist) in "The Tropical Agriculturist" (Ceylon), September, 1910.

Basic Slag. The next great development in regard to phosphatic manures came from a very unexpected source—the introduction of basic slag as a waste product in steel making. A great many ores of iron, notably those found in the Cleveland district of North Yorkshire, contain considerable quantities of phosphates, and in the process of smelting in the ordinary blast furnace much of the phosphorus passes into the iron. As far as the product of the blast furnace goes—the cast iron—the presence of phosphorus does no particular harm, but as soon as the cast iron has to be converted into steel it becomes highly objectionable. With the general introduction of mild steel, obtained cheaply by the Bessemer process of blowing air through the molten cast iron until all the carbon and silicon are burnt out of it, and then adding just enough of an iron rich in carbon to get back the proportion of carbon and iron which forms steel, the Middlesborough iron made from the Cleveland ores was at a serious disadvantage, since it contained a considerable amount of phosphorus which could not be removed in the Bessemer process After much research two chemists, Thomas and Gilchrist, invented a process for removing the phosphorus in the Bessemer process and so obtained a phosphorus-free steel from the impure

Middlesborough iron. Their plan was to line the "converter," the great vessel containing the molten iron through which the blast of air was forced, with a "basic" lining composed of lime and magnesia, instead of the previous acid lining of bricks composed mainly of silica. Lime was also added to the converter, and when the oxidation due to the blast of air takes place in the molten metal, in presence of the lime the phosphorus oxidises as well as the carbon and silicon, because the resulting phosphoric acid is at once taken up by the bases present and so removed from the action, instead of being immediately reduced again by the molten iron. Under these conditions the resulting slag, or molten impurities derived from the iron, which is "basic" from the excess of lime instead of "acid" as usual from excess of silica, contains considerable quantities of phosphoric acid, ranging from 12 to as much as 23 per cent. At the present time the Bessemer has largely been replaced by the "open hearth" process of making steel, but as the principle is the same, the oxidation of the impurities in the iron by a current of air—it can similarly be carried out in the presence of lime with the production of a "basic slag" containing phosphoric acid. . . Basic slag, basic cinder, or Thomas phosphate powder (the two latter names are little used in the United Kingdom now-a-days), comes into the market as a dense black powder, so finely ground that four-fifths of it will pass through a fine brass wire sieve carrying 100 meshes to the inch, which is found to pass only particles having a smaller diameter than 0.2 mm. A small but varying amount of free quicklime is present; from 2 to 10 per cent. may be obtained from fresh samples by careful extraction with pure carbon-dioxide-free water. Both free iron and magnetic oxide of iron are present, and can be separated from the bulk by means of a magnet; this test, together with the presence of free lime, the density of the material, and the evolution of a little sulphuretted hydrogen on treatment with an acid, make it easy to distinguish between basic slag and made-up imitations in which the phosphates are derived from ground phosphate rock.

A. D. Hall, M.A., F.R.S., in "Fertilizers and Manures."

Catalysis and Enzyme Action.

One of the most striking characteristics of the chemical changes taking place in living organisms is the ease with which bodies of a highly stable nature are split up. Glucose, for example, is oxidised to carbon dioxide and water, egg-white is hydrolysed to amino-acids. Under ordinary laboratory conditions, powerful re-agents, such as chromic acid and boiling hydrochloric acid are necessary to effect these decompositions. This fact, which is of course, familiar to all workers

in bio-chemistry, was, at an early date in the history of the science, especially called attention to by Schönbein.

Phenomena of a similar kind are, however, known to chemists to take place in the laboratory, and such reactions are known as "catalytic" reactions. They are increasing in number and importance every day. Oxygen and hydrogen, for instance, at ordinary temperatures combine so slowly that the production of water cannot be detected, the application of a flame or electric spark being requisite. But the presence of a minute quantity of finely divided platinum is sufficient to cause combination to take place at room temperature. Again, the oxidations effected by hydrogen peroxide proceed in many cases at a very slow rate by themselves, but can be enormously accelerated by traces of iron or manganese, as in the well-known methods of Fenton. Another case of interest in connection with enzyme action is the hydrolysis of cane sugar by acids (ionic hydrogen). The most profitable way of studying the problem before us is to consider first of all the essential characters of catalysis, as manifested by reactions where the bodies concerned are of known chemical composition.

For this purpose we may conveniently divide reactions into two classes.

i. There are a large number of reactions which are practically instantaneous : those between ions forming the chief part of this class. When a chloride is added to a solution of silver nitrate, a precipitate of silver chloride falls at once. Or, where a strong acid is neutralized by a strong base, the union takes place at once, as we know by the regular titration methods.

ii. On the other hand, there are reactions, like the saponification of esters by caustic alkali, which take a measurable time to arrive at their final state.

Now, a "catalyst" is a body which alters the rate of reactions of this latter class. The change may be either in the direction of acceleration or of retardation, and the reaction may be one that, by itself, either proceeds rapidly or so slowly that it requires special proof to show that it is taking place at all. It is specially to the acceleration of this latter kind of reaction that the name of catalysis is usually given. although, in theory, any change of the rate of any reaction by the addition of a foreign substance comes under the same category.

W. M. Bayley, D. Sc., F.R.S., in "The Nature of Enzyme Action."

Agricultural Instructors' Reports.

The following is a summary of the reports of the agricultural instructors stationed in country districts, for the quarter ended December :—

BERBICE.

Mr. Mansfield has paid visits up the Canje Creek and the Berbice River, as well as to properties near New Amsterdam.

The majority of the grants on the lower Canje have only been bought for the purpose of obtaining wood for fuel purposes. In the upper Canje provisions are grown by the grant holders. The proprietors are all engaged in the Balata Industry, and they only return home to recruit their strength of during the 'off seasons.' Provisions planted before they went into the 'bush' are reaped on their return and more are planted. Practically no cultivation is carried on. Tillage is unknown and drainage is attempted by very few of the farmers. Land is worked for two or three years and then new land is taken in. The only agricultural implements seen were axe, shovel (very rarely), cutlass, and hoe.

Provisions. The 'cultivations' generally are $\frac{1}{3}$ to 3 acres in extent, but one farm visited had 8 acres under mixed crops. Plantains, cassava, yams, tannias, eddoes and sweet potatoes are all grown, and are generally smothered with grass and weeds.

Rice. Cultivations of this crop are generally about two acres in extent, and the yields average about 8 bags to the acre. Land for rice is cut down, burned, and cleared, and in May is sown with rice broadcast, and in September and October it is cut. Between sowing and reaping nothing is done, and all the rice grown is used by the growers themselves. The rice fields of one year are generally the ground provision fields of the next. Instruction was given in the cultivation of rice and several of the leaflets recently issued were distributed.

Coconuts. One coconut estate was visited having about 2,500 trees planted upon it. The nuts were not very large and some disease was to be seen. Other farms usually have a few trees planted near the houses and in some instances the trees were particularly healthy. On the upper reaches of the creek caterpillars are sometimes prevalent and the coconut beetle is found throughout the district.

Fruit trees. A few trees are found on every grant, and at two places oranges are being grown to some extent. The fruit trees were only in fair condition, scale insects and black blight being common.

Cacao. Up the Canje Creek no systematic cultivation of cacao was visited. The older trees are affected with witch-broom and some of the younger trees have also been attacked. Witch-broom is common up the Berbice river, and efforts are being made to get the grant holders to take steps to rid their trees of this disease. With careful pruning and better cultivation, the cacao trees could be greatly improved, and afterwards it would be much easier to keep the spread of the disease in check.

Coffee. The creole variety is largely grown, but in some places was found not to be bearing satisfactorily. Instructions were given in regard to cultivation and pruning.

Limes are being planted on one property in the Canje Creek and a few trees are scattered on the other grants.

Rubber is being planted in some places. Some is growing well but there are cases where the growth is only poor. In the majority of cases where growth is not satisfactory the soil is unsuitable and the drainage not looked after.

POMEROON.

Mr. Abraham's reports contain the following information :—

Coffee. The pruning of coffee and the removal of suckers is becoming more general on the farms on which previous instruction had been given. The cuts have been smoothed, and in the absence of tar, clay has been applied to the wounds. Mulching is being commenced on some properties, but much more attention to this important operation is being strongly advocated. The placing of mulch too near the trunks of the trees is a common mistake.

Rice. Reaping has been completed on the grants visited. On some of these farms, the yield has been fair and the grain of satisfactory quality, but on many of them the yield has been poor. A scheme whereby the principal rice growers who pay careful attention to their cultivations shall be provided with selected rices grown at the Experimental Fields of the Board of Agriculture is being drawn up, and it is expected that the introduction of these better classes of paddy under observation by the Agricultural Department will have a beneficial effect.

Rubber. There is an increasing demand for rubber plants for this district. Those already planted out are growing satisfactorily and several other grant-holders are anxious to obtain seedlings for planting purposes. Several Hevea trees on one of the grants have been pruned and topped. The importance of shelter from wind has been emphasized on some of the grants on which rubber has been planted. Several well grown trees have been almost uprooted by high winds during the past quarter and others have been damaged.

Plantains, etc. Travelling during the last month has been chiefly in connexion with the attack of giant moth borer in plantains, bananas and sugar-cane on some of the grants in the upper Pomeroon. A wide area has been detected as being infested with this pest. Particulars are being obtained of its distribution and of the damage that it is doing. When the necessary details are completed a scheme for its check and control will be placed before all grant holders, and it is hoped they will co-operate to fight the pest. Specimens have been forwarded for examination in Georgetown. The presence of *Castnia licus* in the Pomeroon indicates how wide spread this pest is becoming, and the damage that it is causing emphasises the importance of active co-operation.

The Experiment Station. The whole of the rubber section has been planted up, while experiments have been commenced with catch crops, cover crops, clean weeding, etc. The drainage of the whole station has been completed, and the section to be devoted to cacao, coffee, limes and coconuts is being planted as rapidly as possible. Already temporary shade has been planted, and the young plants of the permanent crops are now being put in. The section for testing varieties of provision crops and other experiments has yet to be planted up but it is expected that this will be laid out during the next two months.

NORTH WESTERN DISTRICT.

Mr. Matthews reports that the new extension at the Rubber Station has been burnt off and planted up wi h Para rubber 2 roods apart on some beds, and also in rows 2 roods apart with a distance of 2½ roods between the plants in the beds and a plant in the centre of each rectangle of four plants.

The imported varieties of Indian corn have done most unsatisfactorily and do not compare, in either growth or yield, at all favourably with he local variety cultivated in this district.

F. A. S.

Visits to Country Districts.

BONASIKA.

Further visits have been made by the Director, Assistant Director and Agricultural Superintendent in connexion with the tapping experiments, which were continued in the month of October. The yields from the August tappings have been carefully tabulated and the rubber obtained in October is now being weighed. Some difficulty has been experienced with the rubber, as it has shown a tendency in these later tappings to become 'tacky.' Rubber obtained from cuts between six and ten feet high freshly put on has coagulated well and a good product has been obtained, while rubber from re-opened cuts on the same tree has become tacky. The reasons for this are being sought. Different coagulation methods are being experimented with, and in the next tappings smoking will also be tried. Twenty-five seedlings of *Hevea brasiliensis* have been planted two roods apart on the Reserve, and all the lines have been cleared.

ONDERNEEMING.

A visit of inspection to Onderneeming School and Farm has been made by the Assistant Director. Five of the largest Hevea trees were tapped, three with full-herring bones on ¼ of the circumference and two with two basal half V's. Some of the Hevea trees were changing leaf and others were coming into flower. None of these were tapped. The two trees of *Hevea confusa* were visited and the difference between the bark of this species and *H. brasiliensis* carefully noted. The young Heveas recently planted through some of the old coffee fields were making satisfactory progress. The cacao was showing signs of suffering from drought. It is, however, quite healthy except for a few instances of trees attacked by cacao beetles and by thrips. The coffee was also healthy. The most striking agricultural matter thar commanded attention was the remarkably fine growth of the limes on the sand reef near the Superintendent's quarters. In less than one year these trees have made growth equal to what would be considered satisfactory in at least two years. The conditions appear to be very favourable for limes, and the encouragement of the common leguminous plant *Indigofera Anil* on these sand reefs is to be recommended. The newly planted area in limes and catch crops also looks fairly promising.

WEST BANK, DEMERARA.

The Assistant Director and various instructors have visited Pln. Noitgedacht in connexion with the tapping of *Hevea brasiliensis* there, and they have also paid visits of instruction to various plantations and farms. The Para trees are giving a rubber of good quality and the yields appear to be satisfactory. The tapping, on the whole, is being carefully carried out. The difference between the barks of *Hevea confusa* and *Hevea brasiliensis* were investigated and careful notes taken. The local *H. confusa* under cultivation has yielded but little latex, and the product obtained from it is very resinous and would be of little or no commercial value. The cane plots in the Farmers' Competition have been judged and the inspection of the cacao, coffee and provision areas has been commenced.

EAST COAST.

The cane plots entered in the Farmers' Competition have been judged by Messrs. Waby and McWatt. Some very good cultivations were gone through and the opinion of the judges was that they showed an improvement in cultivation and condition over the plots judged in former years. D 625 is largely cultivated by the cane farmers, although Bourbon is also cultivated. The inspection of the other provision and fruit plots has been commenced and general instruction to the farmers is being given.

F. A. S.

" Practical " Education !

The British Government spends £15,000,000 a year on the education of children, but gives, I believe, literally nothing for the scientific investigation of scarlet fever, measles, whooping cough, chickenpox, and mumps....In the tropics I have seen a large class of coloured children, almost all of whom were suffering at the time from fever, being taught the dates of accession of the Plantagenet kings !....The history of malaria contains a great lesson for humanity—that we should be more scientific in our habits of thought and more practical in our habits of government. The neglect of this lesson has already cost many countries an immense loss in life and in prosperity.

"The Prevention of Malaria," by Ronald Ross : Surgeon-Major, F.R.C.S., D.P.H., D. Sc., LL.D., F.R.S., C. B., Nobel Laureate.

The Model Gardens.

Record of Attendances.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907:—

	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E.B.	Total Attendances.
1907									
April 1 to June 30	305	337	412	329	12	...	...	...	1,395
July 1 to Sept. 30¶	381	298	202	285	256	...	...	...	1,422
Oct. 1 to Dec. 31	575	293	380	221	288	...	...	...	1,757
1908.									
Jan. 1 to Mar. 31	597	731	389	299	187	...	...	...	2,203
April 1 to June 30	1,438	860	183	274	243	...	...	...	2,998
July 1 to Sept. 30¶	1,698	976	440	199	212	...	...	...	3,552
Oct. 1 to Dec. 31	1,714	819	465	115*	411†	160‡	...	...	3,684
1909.									
Jan. 1 to Mar. 31	1,638	710	338	463	370	302	...	...	3,821
April 1 to June 30	1,707	677	329	142	288	446	...	...	3,589
July 1 to Sep. 30¶	1,252	742	433	436	172	378	223‖	...	4,636
Oct. 1 to Dec. 31	1,876	536	438	236	362	771	439	...	4,858
1910.									
Jan. 1 to Mar. 31	1,282	769	287	370	259	489	465	..	3,921
April 1 to June 30	1,311	558	787	894	303	455	519	403§	5,240
July 1 to Sep. 30¶	1,234	526	910	748	294	510	498	537	5,257
Oct 1 to Dec. 31	1,209	444	1,285	336	295	493	502	592	5,156

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during the instruction given by the Superintendent Teacher. It has not yet been found feasible to keep a record of the many attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.
¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported during 1910. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1907	1908	1909	1910
Sugar, tons ...	99,297	110,657	115,633	106,439
Rum, gallons ...	2,107,129	2,190,580	2,154,317	2,005,873
Molasses, casks ...	1,462	1,431	2,539	2,084
Cattle-food, tons ..	10,378	7,932	9,504	9,379
Cacao, cwts. ...	639	939	574	472
Citrate of Lime, cwts.	3	13	54	87
Coconuts, thousands	553	200	636	994
Copra, cwts. ...	...	186	467	306
Coffee, cwts. ...	2	190	1,122	1,049
Cotton, lbs. ...	63	12	...	...
Fruit, brls. and crates	5	60	1	...
Ground Provisions, value	$2,739.05	$2,115.06	$225.32	$546.12
Kola-nuts, cwts. ...	32	1	38	9
Rice, tons ...	2,700	3,867	4,729	4,927
Rice-meal, tons ...	...	2,498	1,911	1,620
Starch, cwts. ...	26	...	...	4
Cattle, head ...	1,125	1,451	992	1,210
Hides, No. ...	4,772	2,979	3,490	5,569
Pigs, head ...	...	984	872	1,090
Poultry, value... ...	$ 583.60	$ 234.72	$ 224.52	$72.36
Sheep, head ...	174	41	74	123
Balata, cwts. ...	8,814	10,040	9,231	11,302
Charcoal, bags ...	82,957	76,617	78,410	76,881
Firewood, Wallaba, etc., tons ...	6,249	7,051	8,499	10,192
Gums, lbs. ...	5,952	1,133	6,916	2,529
Lumber, feet ...	90,376	53,267	210,137	277,313
Railway Sleepers, No.	4,000	4,000	3,350	9,950
Rubber, cwts. ...	55	61	57	14
Shingles, thousands	1,878	2,996	2,122	2,463
Timber, cubic feet	211,672	214,743	219,516	278,382

Answers to Correspondents.

A.A.A.—Undoubtedly it is *Castnia licus.*

Rev. J. A. (New Amsterdam).—Your valuable contribution containing observations on the plantain disease in the Berbice River district will greatly assist the officers of this Department in devising remedial measures for the control of this disease. The troubles of plantains in this colony involve very complex problems, and careful investigations and experiments will have to be conducted in several affected districts before satisfactory solutions can be obtained. Diseases of plantains as far as they have been investigated appear to have been due to the following causes (a) attacks of various insect pests, (b) unsatisfactory soil conditions and (c) either bacterial or fungal attack. The general term 'plantain disease' is often very misleading, and much more information is required before a satisfactory account of the troubles affecting the plantain can be made. Your observations form a valuable addition to the information at present in our possession : we greatly regret that pressure on our space prevents the possibility, for the present, of publishing them in full.

W.M.—The averages for coconut products in Trinidad are, according to notes in our possession, as follows :—

50—60 nuts = 1 gallon oil.

275—300 nuts = 100 lb. copra.

1 ton copra = 153 to 156 gallons oil.

The relative value of copra and oil is determined by a scale which each estate makes out from its own workings, but the figures given above are averages.

H.L.—Dig your drains by all means. Coconuts must have good drainage.

E.R.—The specimens submitted appear to be *Sapium paucinervum.*

Selected Contents of Periodicals.

Rubber Fungi (lecture by H. N. Ridley, M.A., F.R.S., etc.)
Instructions to Managers and Assistants on Rubber Estates.
The Pine-apple as a Catch-Crop in Rubber Cultivation.
Rubber Trees and Green Manuring.
—"Agricultural Bulletin of the Straits and F.M.S."
—September, 1910.

Campbell's Method of Dry Farming.
—Queensland Agricultural Journal, October, 1910.

The Effectiveness of Earthworms on Soil Productiveness.
Changes in Heated Soils.
Plant-growth in Heated Soils.
—The Journal of Agricultural Science, Sept., 1910.

Bacteriological Research in Phytopathology.
Agricultural Progress in the Tropics.
The Translocation of Carbohydrates in Plants.
—Science Progress, October, 1910.

The Earthworm as Cultivator.

Proof of their (earthworms') beneficial aeration effect was obtained by digging in early spring a piece of very wet ground so as to get the soil into a highly sticky condition. After three months the soil a little below the surface was greenish in colour, indicating reduction; where, however, earthworms had been at work the surfaces of their burrows were red, proof that oxidation had taken place. Their work on the surface of the soil is beautifully shown by its effect on algae and mosses; in pots containing no earthworms these forms soon appear on the surface of the soil, but not, however, where earthworms are present, since the surface is too often disturbed. Then it is possible to pick out at once the pots containing earthworms by their freshly cultivated look in sharp contrast to the compact green surface when worms are absent. Further, the cultivation effected by worms conserves the water supply. It was found that pots without worms required more water to keep them up to their proper degree of moisture than those containing worms.

E. J. Russell, D.Sc., in "The Journal of Agricultural Science," Sept., 1910.

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Panama Hats as a Local Industry.

The discovery that the palm *Carludovica palmata*, from the leaves of which 'Jippi jappa' or Panama hats are made, flourishes in the North Western District of this colony and at the Issorora Rubber Experimental Station, is a fact of considerable importance in view of the efforts which are being made on all hands to find new and profitable local industries. The popularity of the Panama hat, its tempting market price and the steady demand there is for articles of sound quality and fashionable shape all encourage the hope that before long steps will be taken to start the industry locally and encourage it seriously. Jamaica has already taken such steps, and the accounts of the rise and progress of 'Jippi jappa' hat making in that island make interesting reading. In most parish centres, classes in connection with local Agricultural Societies are held for the encouragement of workers, and instructors travel from place to place to assist, advise and report. There seem to be great possibilities in the industry, provided it is taken up seriously —Colombia exports from £80,000 to £100,000 worth of Panama hats annually—and, as *The Journal of the Jamaica Agricultural Society* points out, the making of hats ought to become quite as common as "fancy work." Certainly it is "expert" work and requires proper instruction; but we understand that there is at this moment in British Guiana a resident who has been thoroughly trained under an expert and is quite capable of instructing others in the 'Art and Mystery' of the manufacture of Panama hats.

It is always a wise thing to learn from the experience of others; and it may be of some use in this connection to quote our Jamaica contemporary. "There is in this jippi-jappa hat business a good living to be made by girls if they start to learn the art young enough, and for any who apply themselves and have supple enough fingers,

there is always something to be made in addition to whatever else they may be earning a living from. It seems, however, impossible to awake the country to a sense of the importance of this industry and the money to be made out of it. The cry is for money, but how few people will really bestow themselves to foster any industry. It is not talking of what is desirable that will do much good, it is the working to bring about what is desirable in a practical way that is wanted. . . . . . There has been for long quite an outcry about the lack of employment for girls who are not fitted for field work, and we have endeavoured to meet the cry by encouraging the establishment of hat classes so that girls may learn the art of making jippi-jappa hats. Many, however, do not seem to be serious in the desire to make a fair living . . . . . The great trouble is that they will not come down to business. Business requires a certain style of hat, of a certain quality, delivered at a certain time, at a certain price ; but some hat-makers are oblivious to all this. Some appear to think that if they make a hat, no matter what kind, it ought to be bought—and if it cannot be sold at once for a big price, then we ought to be able to sell it for them. The local market is soon overstocked, but there is a big over-sea market if we provide the style and quality of hat wanted. Then again it is little use making a hat or two. Districts should be organized, so that hats could be made steadily by girls all their time, or their spare time where they are engaged at some other necessary work such as house work. Hats must be got in these districts . . . . . by the score or hundred. We know what we are talking about, having evidence before us of what can be done in this hat industry, if makers settle down to steady, earnest work."

Tapping Young Sapiums.

The plants in the nursery have been tapped lightly in order to see how the wounds on young plants would heal up. The bark of these trees is rather fibrous, and sharp tapping instruments had to be used ; and it was found desirable in re-opening all the cuts to cut upwards. The flow of latex on these 3½ year old trees was poor, but the wounds heal quickly and satisfactorily if care is taken not to injure the cambium. If the cambium is injured or cut a gaping wound often results, and this takes time to heal up.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

Notes.

The Fungicidal Properties of Liver of Sulphur.

An important investigation by Mr. F. W. Foreman, B.A., F.I.C., into the composition and fungicidal properties of commercial "Liver of Sulphur"—so widely used as a cure for and preventative of 'mildew' in delicate plants—reveals some very interesting points. Details of the research may be read in *The Journal of Agricultural Science* for December, 1910 ; but the results may be summed up briefly here. It would appear that the virtue of the 'liver of sulphur' lies, not in the presence of sulphur but in the action of the free alkali. This conclusion was arrived at after a course of careful experimentation ; and (writes the author) the 'results point to the conclusion that the free alkali soda is the most potent fungicidal agent in the whole mixture, potassium hydroxide being also poisonous, but to a smaller extent ....; saturated sulphuretted hydrogen solution and free sulphur have absolutely no adverse effect upon the germination of spores of the fungus.' The experiments, it should be added, were made on spores of *Botrytis cinerea* and of American gooseberry mildew, and the proof that the use of soda instead of potash increases the value of liver of sulphur as a fungicide should, in the opinion of the author, bring about a considerable reduction in the price of the article. Some minor points remain for consideration, but Mr Foreman's results are already of great interest and value.

Ideals in Agriculture.

Dr. J. C. Willis has been so much before the public of late by reason of his writings on Tropical Agriculture, and he has been so happy in his style and matter, that we need make no apology for drawing upon one of his recent articles for the following 'note,' which seems to have a direct bearing upon our local problems. "The third ideal, which we have set forth in greater detail in a recent book, is the one to which we think that opinion is now tending. It is to have the greatest possible diversification of agriculture in the country, within the limits imposed by the soil and the climate. Not only should there be the smallest peasant cultivators, growing or making all that they require, but there should also be the largest kind of capitalist agriculturalists, and there should be every intermediate stage between these two, both as regards race, and as regards type of agriculture. Not only so, but all these forms and races should be

well intermingled, so that the small man may learn by object lessons at his own door, and the big man be provided with labour within easy reach.

"Looking back over what we have thus far considered, it is evident that one of the most powerful, if not actually the most powerful, of the factors causing progress, is increasing density of population, involving a struggle for existence. With a very thin population, the people live upon wild produce, and they progress, with increasing density of peopling, through 'chenas'* to mixed gardens and fields. The denser the population, the fewer 'chenas' and the more fields. The struggle for existence in the north is undoubtedly keener, on account of the greater needs and ambitions of the people, and it is quite possible that the difference in the rate of progress may be entirely accounted for by this difference in the struggle for existence. If this be so, there is little likelihood of rapid progress in the tropics at present, but as the efforts of Governments, societies, and individuals seem to have accelerated progress in the north we may hope that they will do the same in the tropics.

"This being so, we must obviously do all we can to increase the density of population by removing those hindrances to agricultural progress that interfere with it. There are many other factors in agricultural progress. A man who means to practise agriculture must have land, drained and irrigated as necessary. It must be in a suitable climate, and he must have suitable crops to grow upon it, and must cultivate them with the necessary tools. He must have sufficient capital to enable him to plant and wait for the return, and must also have means of transport to enable him to get rid of the crop, and markets in which to sell it, unless he is to remain at the grow-what-you-want-and-consume-what-you-grow stage. If he is to cultivate more than a very minute acreage, he must have some labour besides that of his own family. And he must have enough education to take advantage of all these things. A very little consideration is required to show that all these factors must come in before the actual improvement of crops, methods, tools, and the like, which we may call the scientific improvement of agriculture. A man without land properly settled, without capital and without transport, cannot afford to try experiments with new methods, crops, and tools. It is in the absence, or inefficiency, of one or more of these preliminary factors, that the weak point of agriculture in most tropical countries lies."

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* 'Chena' may be described as 'forest-clearing' cultivation: similar in many respects to that practised by our 'Buck' Indians in this colony.—Ed. J. B. of A.

Rubber Cultivation in British Guiana. III.

(Concluded.)

TAPPING.

Full herring-bones, half herring-bones, spiral cuts, large V's, small V's have all been tried, while simple chisel incisions have also been experimented with. With wild Sapium the best results have been obtained with large V's and with the half-herring-bone system although further improvements are being looked for. With Para rubber, the half herring-bone is the one that is now being very largely adopted, and the Para rubber trees that have been tapped in this colony have been thus treated.

The full herring-bone was commonly adopted in many plantations in the East, but it is generally found to be too expensive and wasteful in bark excision, and is now being superseded by the half he ring-bone system. The area of the tree that should be tapped at any one time has not yet been definitely decided upon in the East, but for the present it would seem probable that half-herring bones excising a quarter of the girths of the trees per annum is the method to be most strongly recommended. The second year's tapping should be on the opposite quarter of the trunk, for it seems most desirable that adjacent quarters should not be tapped in successive years. The usual time that tapping is commenced in the East is when the trees measure 20 inches in girth at three feet from the ground but general opinion is beginning to favour even earlier tappings, such as when the trees average 18 inches in girth. How far this opinion has been influenced by the desire of companies for early dividends is not clear. It would be a safe practice in this colony to adopt the principle that general tapping should not be commenced until 20 inches girth at 3 feet from the ground is reached.

When trees measure 20 inches in girth at one foot from the ground, it has been demonstrated that they can be tapped with basal excisions without detriment, and early yields can thereby be obtained. Basal V's are now commonly adopted, while the method given by Mr. H. N. Ridley, of Singapore, is one that should strongly recommend itself to rubber cultivators. The basal excisions consist of two cuts representing about one half or slightly more of the girth of the tree. The first excision is opened a small distance from the ground upwards and the second is made at a reversed angle on the opposite quarter of the tree. This involves the use of two collecting cups but is recommended for young trees as it gives

" quick bark recovery near the base, no distortion of bark, strong latex, and it can be followed by the half herring-bone without detriment whilst the trees have been increasing in girth." In fact these basal cuts may be made the beginnings of the half herring-bone system of alternate quarters.

THE IMPORTANCE OF TAPPING SYSTEMS.

Rubber planters cannot lay too much stress upon giving very careful consideration to the system of tapping adopted, and the proper laying out of the system finally decided upon is perhaps the *mcst* important duty of the rubber cultivator. How often are V's or half herring-bones put upon rubber trees without the slightest thought as to how tapping is to be carried out in subsequent years, and how often are the 'parings' of the cuts done so unevenly that irregular pieces of untapped bark are left scattered about the trunks of the trees. The excision system of tapping aims at the entire removal of the bark, and this must be done evenly in order that bark renewal may be smooth and regular.

The best system is to measure the girth of the tree to be tapped at about 1 foot from the ground and also at about six feet from the ground. Divide both these two distances in half, so that the tree may be divided by two vertical lines exactly into half. These lines should be made by an acute angled V knife, which answers well as a " marker," and should be of shallow depth. Midway between these two lines another vertical line is marked out, so that the half of the tree being marked has three vertical lines marked on it enclosing two quarters of the tree. Another method is to make a single vertical line which is to serve as the centre groove of the herring bone, and then measure off on each side at six feet and at one foot from the ground a quarter of the total girth of the tree at these heights. These marks are joined together, and the two outside vertical lines are made. It is now necessary to mark out the oblique cuts. The distance between these oblique cuts has to be decided upon. Distances of 12 to 16 inches are commonly adopted, the greater distances when tapping on an estate is being first commenced and the smaller distances after the tappers have gained experience and are able to take off thinner slices in the re-tapping. The angles at which the oblique cuts are made also vary, but angles of 35 to 45 degrees are the most common. The angles for Sapium should be more acute than for Para rubber.

Suppose it is desired to mark out trees with cuts fifteen inches apart at an angle of 45 degrees, it would be necessary first to measure along the centre vertical line distances of 15 inches and make slight

marks on the bark. The first mark should be 15 or 18 inches from the ground and the last mark at 6 feet 3 inches or 6 feet 6 inches. Along one of the side-lines a distance of $15 + 7\frac{1}{2} = 22\frac{1}{2}$ inches will then be measured from the gound, and above that distances of 15 inches measured off. In marking off these distances a stick cut to exactly the desired length and marked with a notch either in the middle (if angles of 45° are being used) or at some other desired place (if other angles are being used) is most convenient, and saves considerable time and trouble. All that is necessary now is to join together the marks made on the two vertical lines and the tree is marked out for tapping.

THE CAMBIUM LAYER.

When tapping is commenced the centre vertical line is slightly deepened to form the conducting channel, and commencing at the top the oblique cuts are then made. Great care must be made not to penetrate too deeply, or in any way to injure the cambium, or growing layer of the tree. If cuts are made too deeply, an injury is done to the tree, disease may begin at these places and bark renewal is irregular. At about three inches from the ground at the base of the conducting channel a small gutter is stuck into the tree which conducts the latex into the cups placed on the ground.

WHEN TO TAP.

Tapping may be done daily, every alternate day, or at longer intervals. Alternate day tappings are now generally in vogue, and figures obtained from experiments in the Straits Settlements between alternate day tappings against every day tappings indicate an advantage of approximately 4% in favour of the tapping on alternate days. Tapping may be continued throughout the year, except when the trees are in flower or fruit or when they are changing their leaves. As the bark on one quarter of the circumference of the trees has to last for a whole year it is obvious that the thinnest slices necessary to re-open the cut laticiferous vessels must be taken off, and in no instance should the cuts be allowed to exceed or to fall short of the side vertical line which has been made to define the limits of the cutting. The side lines are marked out to guide the tappers and they *must* be made use of. Otherwise irregularly shaped pieces of bark will be left untapped, and the trunk of the tree will be uneven when the excised bark is renewed.

Tapping is generally carried out to a height of 5 or 6 feet, it being conceded that the basal portion of the tree gives the greatest yields. Recently, however, experiments in Ceylon indicate that satisfactory yields may be obtained from heights above 6 feet, but whether the

extra expense in tapping will prevent this system from being generally adopted has yet to be investigated. The richest latex is always obtained from the basal cuts, and not infrequently these cuts yield the greatest quantity.

TAPPING TOOLS AND COLLECTING CUPS.

A numerous and varied assortment of tools for tapping is now presented to the rubber cultivator. A large number have been expemented with by the Department of Science and Agriculture, and the following have been found worth recommendation :—

1. For marking out—Any acute-angled V shaped knife.
2. For first tappings—
   - (a) The Alpha Safety knife, right and left handed.
   - (b) The Jebong or improved Farrier's knife, right and left handed.
   - (c) The Push-and-pull knife—adjustable.
3. For re-opening cuts—
   - (a) The Para Chisel—useful for large forest trees.
   - (b) Gouge, rounded and of a breadth of $\frac{5}{16}$-$\frac{3}{8}$ inch.
   - (c) Barrydo tapping knife.

It is unnecessary for any plantation to have all the above, but at least one kind out of each group is necessary. Many of the patent tapping knives are absolutely useless, and on the greater number of the estates in the East the marker, the 'Jebong' and the 'Gouge' are the only tools used. Cultivators are also warned that many of the the 'Improved Farrier's knives' as manufactured in England are useless for work on the estates as the cutting parts of the knives are set at wrong angles.

The collecting cups may be of metal or glass, but, except in stony situations, the glass cups, with pointed bottoms so that they cannot be used in the houses of the labourers for drinking purposes, are now most generally preferred, as they can easily be washed and they will not rust.

COAGULATION.

At the present stage of the rubber industry in this colony it would serve no useful purpose to give an account of the different methods used for coagulation in the East, nor of the various experiments, which are yet incomplete, that are in hand in connection with the latex of Sapium in this colony. It has been our experience that coagulation with acetic acid is on the whole fairly satisfactory.

The *latex after collection is strained and in* the case of Para rubber may be diluted with clean water. With Sapium latex, however, no water should be added. Acetic acid, at the rate of ½ oz. of glacial acetic acid to one gallon of undiluted rubber latex, is added, and the latex then set in soup plates or shallow trays. The rubber appears gradually and may be taken off as a thin biscuit or sheet from the top of the mother liquor. It has then to be washed in clean water, rolled or squeezed to remove some moisture and finally hung up in a dark, cool, airy place to dry. It should not be hung where the sun's rays may strike it, should not get too much light and should not be packed away until it is perfectly dry. Without doubt very many improvements on the above method can be mentioned, but the simplicity of the above method recommends it to cultivators who are only just commencing to make rubber. Sapium rubber from the 'bush' may be collected as scrap. If this is collected wet, then washed and properly dried, its value would be considerably enhanced.

BOOK-KEEPING AND RECORDS

In conclusion, we cannot urge too strongly upon rubber cultivators in this colony the necessity of keeping careful books of account and records. The statements of costs of cultivation from the beginning are often invaluable and form an excellent control over future work, while when tapping is commenced statements showing the *number of tappers*, the number of trees tapped, the quantity of latex obtained and the quantity of dry rubber obtained make it possible to obtain a fair average idea of the average yield per tree and the costs of production.

A careful book control over the expenses is most desirable, but often it is the part of estate management that is most neglected.

J. B. HARRISON.

F. A. STOCKDALE.

Agricultural Students in Coimbatore (India.)

The total number that can be accommodated is sixty—so that twenty students are expected to pass out each year. The selection of students is left to the Principal, and endeavour is made to select those who will get the most advantage from their training and have the widest influence after they leave. For this reason men of the land-owning or farming classes are, in general, selected, care being taken at the same time to recruit representatives from as many districts as possible. The applications last year numbered nearly 150.

—"The Agricultural Journal of India," Oct., 1910.

Tuberculosis and our Milk Supply.

During an acting appointment at the Georgetown Abattoir in 1909, I made a special study of the prevalence of tuberculosis in the cattle slaughtered there. My object in doing this was two-fold :—

(a) To throw some light on the possible connection of the milk and meat supply with the prevalence of tuberculosis among the inhabitants of the colony.

(b) To determine to what extent the open-air life to which our cattle are accustomed acts as a deterrent to the spread of this scourge among them.

As a result of my investigations I found the carcasses at the abattoir were very free from the disease, the number of cases I detected being less than 1% of those I examined.

I acted for six months, and during that time thousands of cattle were slaughtered; I was most careful in examining each carcass, the visceral organs and lymphatic glands were thoroughly inspected as in the latter tubercles are often found when they are undiscernible in other parts. The few cases that did come under my observation were either caseous or old calcareous nodules, but in no instance can I remember finding a case of miliary tuberculosis. From these facts it will be seen that the contamination of our milk is not brought about to any appreciable extent from infection by cattle; and it must therefore be due to some other cause, such as diseased milkers spitting on their hands during the process of milking; dust and other foreign matter gaining access to the milk; the animals being milked in an atmosphere teeming with bacilli; or milk being adulterated with water contaminated by excreta, etc.

There is not the slightest doubt that the effect of an open-air life on cattle is to restrict the development and spread of tuberculosis, and probably in some cases it acts as a curative. This opinion seems beyond question, as in the following countries where animals are housed the statistics are as follows :—

Prussia—Slaughter house statistics show 14.6% of the cattle to be tuberculous; Saxony 29.13%; Leipzig 36.4%. In Belgium 48.88% reacted to Tuberculin (an infallible test in the hands of an expert); Denmark 49.3% reacted. Great Britain shows that 26% of slaughtered and tested animals are tuberculous, whilst McFadyean estimates that 30% of the cows in Great Britain are tuberculous. On the other hand less than 1% of the animals tested here prove to be tuberculous.

Further evidence in favour of an out-door life is that in the United States where animals used for slaughter are principally obtained from the ranches, oxen sufficiently diseased to cause condemnation of any part of the carcass average about 0.11%. I recommend that those responsible for the prevention of the spread of tuberculosis should, as much as possible, encourage the owners of cattle to keep their animals in pastures, and merely to use sheds for the purpose of milking in when the weather renders it necessary. The fact that in a country like ours consumption is rampant among a certain class, and that class contains those who are usually in attendance on the milch-cows, seems to raise another interesting point, namely, to what extent are cattle prone to tubercular infection, and what is their susceptibility when kept under natural conditions—unhoused ?

Another point worthy of consideration in connection with this terrible scourge in our midst is that the chief sufferers are, in the majority of cases, not milk consumers.

To me it seems conclusive that those interested in alleviating the sufferings of consumptives and introducing prophylactic measures to check the spread of tuberculosis must, if they wish to be successful, direct their efforts to sources far more likely to produce the causal agent than is our friend the cow.

MILK REGULATIONS.

Milk regulations cannot be made effective unless a systematic inspection of cattle and their byres and pens be instituted and steadfastly carried out. Such an inspection should be by inspectors appointed by the Governor, and these officers should be under the direction of a veterinary expert whose duty it would be to see that they do their work faithfully, and only pass byres and pens that comply with the regulations. As things are now, if one inspector does not pass a byre another will. Then we have the "registered Veterinary Surgeon" (whose sole qualification in many cases is his registration) being allowed to certify an animal as free from tuberculosis. I believe one of the "registered Veterinary Surgeons" has a certificate acquired by correspondence. What can be the value of a medical certificate obtained by correspondence ? Imagine the wealth of knowledge in anatomy, physiology, pathology and histology such a person would possess. Such are some of the people authorised to safeguard this community against tubercle, typhoid, diarrhœa, etc., by their being allowed to certify cattle and pens.

If those in authority wish to treat the milk question successfully they must adopt practical and workable measure even though it may increase the colony's expenditure by a few hundred pounds per

annum. A small monetary consideration should not be allowed to act as a deterrent in protecting human lives, and the practically promiscuous issuing of certificates should be abolished.

There are many simple methods of obtaining a milk supply that would certainly be a great improvement on the present one :—

(a) Abolish all cow byres in Georgetown—and in the colony if possible.

(b) Encourage the owners of cattle to keep them in the open, and, when the weather permits, to milk them in the open.

(c) Issue leaflets to the owners explaining the importance of an open-air life for cattle ; the necessity of cleansing the tail, thighs, and udder previous to milking ; the danger incurred by the filthy habit of spitting on the hands during the process of milking ; the absolute necessity of keeping all milk utensils clean ; and the gross injustice and danger to the consumer of adulterating milk with water, more especially trench water, which is not unfrequently contaminated with excremental matter. Besides issuing such leaflets, regulations on the above principles should be framed, and a severe penalty imposed upon anyone found guilty of breaking them.

The duty of the inspectors suggested herein would be to pay surprise visits during the hours of milking, and prosecute anyone who might be found violating the above rules. The Chief Inspector might be a graduate of the Royal Sanitary Institute, as in this way we would ensure full competence. Weekly reports might be submitted to the Government Veterinary Surgeon who should report on them to the Chairman of the Local Government Board. At the present moment there is practically no control whatever either over the milk supply, byres, or pens outside of the city, or over the milkers. For instance, many an owner obtains a certificate for two cows when in reality he is milking six or more, and those not inspected may be diseased. Many an owner obtains a certificate as a milker and seller when others of his family assist in the milking.

The control of the milk supply can be made practieal and efficient, but to do so it must be based on sound methods of supervision, not on the slipshod principles at present in force.

The housing question, taken up so keenly some years ago, seems to be lying dormant at the present time, and yet is it not conceivable that this is the most important factor in the spread of tuberculosis in the colony ? What better media can we have for the development of tuberculosis bacilli than such atmospheres as exist in these terrible yard rooms, the ventilators of which are often stuffed with all sorts of rubbish to prevent fresh air from gaining an entrance. Here again

we want a proper system of inspection and trained inspectors, at the head of whom should be a qualified sanitary inspector. I am afraid our local inspectors have not had sufficient technical training to enable them to fully appreciate the value of hygiene, and to realise the importance of their duty to the community by insisting on the advice of those competent to give it being carried into effect. It is unfortunate that these men cannot attend a short course of instruction in practical hygiene such as is given to our primary teachers so that they could see for themselves the importance of sanitation generally and especially of the germ theory in relation to disease.

J. A. RALEIGH, V.,S., Can., M. R. San. I. Eng.,
Government Veterinary Surgeon.

Protecting Plants against Slugs and Snails.

The method is, in brief, to add one or two large tea-cups of phenyle to ten or twenty cups of water, and use the mixture to moisten a bucket of sawdust. The sawdust is then spread round the rows of plants to be protected, or round single plants ; if the area enclosed is a large one, it is also sprinkled on the surface of the soil. The protective action is remarkable. It persists even after a heavy rain if the sawdust is not washed away, and it lasts for a considerable time. During wet weather a stronger solution can be employed, since the phenyle slowly washes out of the saw-dust. No injurious action is exercised on the plants nor upon the soil as the sawdust slowly works into it. The effect of depriving the animals of their food is to cause a marked decrease in their numbers, quite apart from any poisonous action. The labour and cost involved are exceedingly small, a bag of sawdust at 1s., allowing 6d. for carriage, and 1s. worth of phenyle at 3s. 6d per gallon will be sufficient for a fairly large garden.

The method is particularly effective and useful for protecting young tomato plants, which, in the young seedling condition, are often destroyed by slugs or snails when planted out, by being eaten at the base near the ground. As soon as epidermis or skin of the plant thickens, and acquires its proper hairy covering, the plants are immune to their attacks, whereas such plants as cabbages, etc., are liable to attack so long as the weather is moist, and hence need longer protection.

—A. J. Ewart, D. Sc., Ph. D., F.L.S., Govt. Botanist, Victoria (Australia), in Journal Dept. of Agric., Victoria, Dec. 1910.

Hints on the Management of Rubber Estates.

The first, last, and only reason for managers, assistants, and coolies being employed on the estate is the production of latex. The one aim and object of all expenditure of money and labour is the production of the greatest quantity of rubber of the best kind at the lowest possible cost.

CULTIVATION.

Whatever kind of cultivation and tree sanitation is best for the locality, and tends to produce the best possible trees and latex, will be found the cheapest in the end—be it clean weeding, growing selected weeds, or growing everything to be turned in at certain fixed periods.

COOLIES.

The argument put forward above for the utmost well being of each individual rubber tree applies with still greater force to each individual coolie on the estate. No expense or trouble is too great that will ensure a well housed, healthy and contented labour force.

WORK IN DETAIL.

All coolies on the estate of whatever description, men, women, and children, indentured and free, married and single, watchmen, cartmen, etc., are to be turned out for muster every morning, including Sundays, by the Manager or European Assistant, and the Apothecary, counted, medically inspected, and treated.

All coolies, lines, drains, water installations and latrines, are to be inspected daily by the Manager or one of European Assistants.

HOURS OF MUSTER.

Free coolies to be mustered and medically inspected at 5.30 muster only. Sundays excepted.

INDENTURED.

All indentured coolies, together with their wives and children living on the estate are to be mustered twice daily in their respective gangs.

Once every evening in the presence of the night guard before being handed over to them, and the number recorded and certified by the Manager or European Assistant in Night Muster Book.

Once every morning at 5.30, when taking over from the night guard, the number recorded and certified by the Manager or European Assistant in Muster and Distribution Book.

Lights out at 9 p.m.

All fit coolies after muster and medical inspection are to be told off for work not later than 5.45, and the details as set out in Muster and Distribution Book recorded.

An inspection of all implements used is to be made daily, either at evening or morning muster, by the assistant in charge of each gang. The coolies must be taught to keep all tools in good working order. It is impossible for coolies to do their work easily and well with blunt or damaged implements.

FIELD WORK AND DAILY ROUTINE.

After muster, if the work is not too far off, the coolies are to be taken to the field and set their task by the Manager or Assistants who return for breakfast at 7. At 7.30 they go to their gangs and remain with them till 11 a.m., when they return for tiffin.

They go again to the field at 1 p.m. and remain with the coolies till the day's work is finished. On returning from the field the work for the day is to be recorded. A price book is to be kept by the Manager and Assistants of all work, whether task, or not, and the cost per acre or job is to be recorded, together with field and square number, day by day, and submitted to the Manager. One of the most important duties of the Manager is to see that good work is done as cheaply as possible, and that the value of the wage of every individual on the estate is got in good work.

TREE SANITATION.

Each individual tree is to be thoroughly and minutely inspected for the three following diseases :

White Ants	..	..	..	" *Termes Gestroi* ".
Root disease	..	..	..	" *Fomes semitostus.*"
Stem and branch disease	..		..	" *Diplodia rapax.*"

This work is of the utmost importance, as on it depends the successful development of the estate, and it is impossible for me to impress upon you too strongly its vital importance.

BRANCH DISEASE.

This can be detected by the unhealthy appearance of the leaves in the first stage, and by the dead branches in the second. This appearance is similar to that produced by root disease, but with this difference, that the tree suffering from branch disease is firm in the ground. Patches of black latex will probably be seen on the trunk and branches.

ROOT DISEASE.

As far as I know, there are three signs of this disease :—

(1.) The dried-up appearance of the trees, caused by the cobweb threads round the roots cutting off supplies.

(2.) The loose hold the tree has in the ground, which can be detected by shaking the tree.

(3.) A sunken-in appearance on one side of the stem low down on the side attacked.

PRUNING.

Prune all branches that are within 12 feet of the ground. All branches must be cut as close to the stem as possible, and tarred at once. No tar to be allowed to run down stem. The branches are to be sawn off. If the branch is a large heavy one, it will break away and wound the tree when about half cut through. To avoid this, slash off at least half of the branch and then saw off the remainder.

WOUNDED TREES.

All trees wounded are to be tarred directly wounds are made, or discovered in any part of the estates. If there is no tar handy, send for it at once, and see the tree tarred. Do not merely order it to be done. Also see that tar is not allowed to run down the tree. Tar for this work, and also for marking trees requiring attention, must be taken by every working gang together with saws and pruning knives.

REMOVING TIMBER.

Remove all timber from the trees and stack in the middle of the lines of rubber for trimming. Burn as much wood as possible in long, low narrow heaps, not more than 3 feet high, between the lines. It is a good plan to cover the heaps of wood with earth, make air holes and fire the heaps ; it will smoulder away without scorching the rubber.

Stumps of big trees can be burnt out without damage to the rubber, if a trench 4 feet wide and 3 feet deep is dug right round the stump, and the trench filled with logs, etc., cover with earth leaving air holes, and fire : the stump will smoulder away. This will also destroy the ants.

LEANING TREES.

All trees leaning over should be propped up straight, with three props ; bind grass between tree and props.

RECORDS.

The following information is to be recorded in the Tree Inspection Treatment Book, taking square by square :—

1st. Date.

2nd. Particulars of manuring, if any.

3rd. Total number of trees in each line in square and total in square, numbering lines in squares E. to W., and trees in lines from N to S.

4th. Trees diseased and nature of disease, line by line and tree by tree.

5th. Particulars of treatment do.

6th. Measurements of trees

7th. Vacancies do.

8th. Supplies. do.

9th. Recommendations *re* disease, drains, etc.,

Under no circumstances whatever is the Estate to be left without the Manager or one European Assistant.

—Extracts from Article by C. Alma Baker in "Agric. Bulletin, Straits and F. M. States," Sept., 1910.

Twenty Years Rain.

The determinations of the chlorine and the nitrogen in the rainfall of British Guiana having now been carried on continuously for a period of twenty years, it is convenient to record the results :—

In round figures the mean rainfall during the twenty years over which our records have been made was 99 inches; the average rain water contained (per litre of water at 84°F.) 5.162 milligrams of chlorine ·018 milligrams of nitrogen in ammonia salts and ·034 milligrams of nitrogen in nitrates.

During the twenty years the monthly ranges of variation in the constituents of the rain have been very wide—chlorine ranging from 1·770 to 37·131, nitrogen in ammonia from *nil* to 1·275, and nitrogen in nitrates from *nil* to ·823 milligrams per litre of water at 84°.

These correspond approximately to an average annual downfall of 98,706 tons of water per acre, containing chlorine equivalent to 195 lbs. of common salt and 2·9 lbs. of combined nitrogen, in the forms of nitrates and of ammonia.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

The Question of a Banana Industry. II.

To the number of *The Journal* for October, 1909, Mr. Stockdale contributed an interesting and comprehensive article on "The Question of a Banana Industry," in which he reviewed the world's trade in the fruit and the points to be considered in connection with the establishment of plantations on the commercial scale, and summed up the methods of cultivation obtaining in Jamaica and those thought suitable for this colony. The terms of the Surinam contract were also given. As the question of establishing the industry, if feasible, seemed pressing, the Government appointed a Commission, and they sent a delegation to Surinam to investigate the industry as carried on there. This Commission has now reported; and its findings and conclusions—based practically entirely on the findings of the delegates (The Director and the Assistant Director of Science and Agriculture, with Mr. J. Wood Davis, F.R.)—are so striking and so important, that they are given here in full. It is a striking fact in view of the report of the delegates from British Guiana, that the Dutch Government in Holland has since decided to suspend any further assistance to the Surinam banana cultivation, which may, in consequence, disappear as a large commercial undertaking unless the United Fruit Company support it with the object of developing the cultivat on of the Congo variety of banana in place of the Gros Michel.

POSITIONS OF THE PLANTATIONS AND THE NATURES OF THEIR SOILS.

"The estates on which bananas are cultivated in Surinam are river estates. They are situated on the Surinam and Commewijne rivers which join together with a common estuary about nine miles inland, at a point about nine miles north of Paramaribo, the principal town of Surinam. Paramaribo itself is about 18 miles inland, and the principal banana estates are within easy distance of that town. The soil of the estates visited varied from a very fertile moderately stiff clay-loam to a rich, friable, sandy loam. The types of soil seemed to change more suddenly than they do on the coastlands in this country, and it was not uncommon to see two contiguous fields showing marked differences in agricultural value. Some of the soils resemble closely the soils at the back of the sugar estates on the East bank of the Demerara river and on Canal No. 1, others more closely resemble soils in the Pomeroon and the North West Districts, but no lands we examined are as heavy or

as tenacious in character as are the great majority of the front lands of the sugar estates and villages of British Guiana. It was particularly evident that the more loamy and friable the nature of the soil the easier it is of cultivation and the more vigorous is the growth of the bananas, and that the heavier, more tenacious soils produce less healthy growth of the plants and fewer and smaller bunches of bananas. Hence we consider that the cultivation of bananas cannot be regarded as a possibly remunerative industry on the more or less abandoned areas on the front lands of the sugar estates or on much of the land occupied by villagers and farmers on the sea-board of British Guiana.

THE YIELDS PER ACRE.

"The yield per acre, varies considerably. In 1908, on estates obtaining advances from the Government, the yields varied from 11.7 bunches per acre at La Ressource and Meerzorg to 84.6 at Dordrect, and in 1909 they varied from 36.8 at La Ressource to 173.2 at Johannesberg, while the average yield of all these estates was 36.6 bunches per acre in 1908 and 90.4 bunches in 1909.

"On estates receiving no Government advances the yields varied from 10.5 bunches per acre at Brouwerslust to 88.5 bunches at Berlijn in 1908 and from 28.3 at Leonsberg to 129.1 at Berlijn in 1909, while the average number of bunches per acre from these estates was 33.5 in 1908 and 66.0 in 1909.

"These yields were so much below the average of Costa Rica and Jamaica, where from 275 to 300 bunches per acre are obtained on the majority of well managed estates, that we inquired into the various causes of the small average yields in Surinam. At the outset we were informed that diseases are largely responsible for them, that of a total area of 8,000 acres under bananas it has been estimated that practically 3,000 acres have been destroyed by diseases, whilst it is further estimated that the damage by diseases on lands affected, but where the bananas have not been entirely destroyed, is equivalent to the product of at least another 1,000 acres. In other words, through the ravages of diseases, the production has been reduced to one-half and it might reasonably be estimated that if Surinam bananas were free from diseases the average production per acre would approximate 170-180 bunches under the present systems of cultivation. On one estate a yield of 405 bunches per acre were obtained from 30 acres while another large estate obtained an average of 203 bunches per acre during its first year before disease broke out, while now its average is about 85 bunches per acre.

DISEASES AND BEES.

"The diseases that have occasioned the greatest damage have been the Panama disease and a disease called the Surinam disease, whilst bees have been responsible on some estates for a very great amount of damage. At Meerzorg, 12,000 to 15,000 bunches or over 20 bunches per acre were actually lost in 1908 by spotting by bees, while all the labourers had to be employed in destroying bees rather than in cultivating bananas so that the extent of damage was not limited to these 12,000 to 15,000 bunches. Occasionally still larger losses have been suffered through bananas been blown down by winds, especially in exposed situations.

"These various causes of loss have to be given very careful consideration by the Committee as cultivations of bananas in this colony would be liable to the losses from similar causes, if not at the outset at no distant date after commencing the cultivation on a large scale. Bees already cause a considerable amount of damage to plantains and bananas here, winds would undoubtedly cause havoc at times especially to Gros Michel bananas, while there are good reasons for believing that the Panama disease of bananas is not unknown in British Guiana.

THE COST OF CULTIVATION.

"The advances made by the Government to those estates requiring money to commence banana cultivation have been carefully worked out in order to cover total cost of management, cultivation, etc., and from enquiries upon the estates themselves it was ascertained that these amounts are sufficient in ordinary circumstances. The general consensus of opinion amongst the managers of estates whom we consulted was that $45 to $50 per acre was the cost of planting up bananas and of their cultivation for the first year, while $24 per acre would suffice to meet all cultivation, transport and other charges during subsequent years until re-planting is required to be undertaken. These amounts do not include the money that has to be expended on obtaining immigrant labour, which is shown on estates as a separate charge and which, in our opinion, must be a somewhat heavy item in the total costs of the bananas shipped from estates which have had to resort to immigration for the additional labour requisite for the new industry.

THE TERMINATION OF THE CONTRACT AND THE INCEPTION OF A RUBBER INDUSTRY.

"In view of the termination of the contract in 1916 and the possibility of its not being renewed, the Government of Surinam ap-

pear to be taking a very active interest in establishing rubber through the banana cultivations. Surinam is possessed of a considerable number of vigorous trees of *Hevea brasiliensis,* grown from seed obtained from Ceylon some years ago, growing in its Botanic Gardens and scattered about ome of the estates. These are producing seed in quantity and it is likely that within a year or so they will produce more seed than will be required for local use. The planters, however, are being encouraged to raise young plants and to put them through their banana cultivations whilst recently further supplies of seeds have been obtained from the East. The late boom in rubber has further stimulated interest and it is likely that a considerable quantity of the banana land will be planted in rubber, further land being taken up for bananas should occasion arise. On many of the estates the young rubber plants are growing very satisfactorily and the good drainage absolutely necessary for banana cultivation and the improved methods of cultivation that have had to be adopted for the bananas has been of great assistance to the young Para rubber trees and healthy, vigorous growth is being made by them. The bananas during the first two years or so seem to have no harmful effects on the growth of the young Para rubber plants provided the bananas are not planted so closely as to prevent the Heveas from getting sufficient light. It is possible, however, that wind belts will have to be established on some estates. There seems to be very fair promise in this mode of planting rubber. Sufficient other land is available for bananas as it may be required, and the planters will probably at some later date look upon the intensive methods of cultivation demanded by the banana industry as a distinct advantage in connection with the installation of young rubber plantations and will continue them. It appears to us to be very wise policy on the part of the Government and the planters in making the banana industry a transitional industry between the possibly more or less defunct cacao industry and a thriving rubber industry. If the witch-broom disease is successfully combatted and the Congo variety of banana proves of such economic importance as to warrant the further continuance of a banana industry, the Government of Surinam will be in time amply rewarded for its present determined efforts, its admirable courage, patience and fortitude and its resource in a time of acute adversity.

SUMMARY AND CONCLUSIONS.

"In conclusion we had to satisfy ourselves whether a banana industry similar to the one in Surinam could be established in this colony, or whether we could entertain hopes, after our experience in the former country, for a successful industry here. The following are the more salient points in this connection :—

" We are fully satisfied that the major part of the readily available front lands of this colony is not well suited for the production of bananas on the commercial scale ; that it is quite hopeless to look for their production on such a scale on the wind-swept abandoned lands of the present sugar estates and of earlier cultivations ; and that the great area of land otherwise well suited for banana cultivation which lies at distances of from ten to thirty miles from the coast-line cannot be successfully developed for such purpose in the manner similarly situated land is being so cultivated in Surinam. As already pointed out no part of this colony possesses the exceptional shipping advantages the banana lands of Surinam enjoy.

" Those in control of banana plantations would have to allow themselves not alone to be guided but to be autocratically directed and controlled by the agent of the purchasing company. This we are certain that, unless under stress of conditions that have not yet occurred in this colony, the planters and farmers of British Guiana would never consent to.

A banana industry as has been conclusively proved in Surinam can only be carried on where efficient labour is available and under complete control, and the establishment of such an industry here would inevitably require extension, according to its scale, of East Indian immigration.

" Banana planters would be completely at the mercy of the United Fruit Company and their purchasing agencies. The experience of Surinam with the Gros Michel variety of bananas and the fact that the Panama disease is not unknown in British Guiana show that they would be compelled to fall back on the cultivation of the Congo variety. The United Fruit Company have the monopoly of supplies of suckers of that kind.

" At the outset we approached the Surinam manager of the United Fruit Company as to whether his Company would be prepared to accept bananas from British Guiana, and were informed that on receipt of letters in May from this delegation in regard to our projected visit he had written his principals in New York who had cabled and subsequently written that the United Fruit Company was not prepared to consider or to undertake any more contracts for bananas as the demand during the past few years had not been increasing at the same rate as had the supply. The United Fruit Company owned large areas of land in Costa Rica and other Central American Republics and we were informed by their Surinam manager that if any extension of land under banana cultivation was required the Company would rather extend upon their own

lands than make contracts with any other country or association. That this extension was not likely to take place was impressed upon us and we were informed that the Company had lately changed very large areas of land which they own in Cuba from banana cultivation to that of sugar-cane.

"We next enquired, as fully as possible, into the operations of the United Fruit Company with a view to ascertaining whether it would be possible to commence the shipment of banana independently of that Company. So impressed were we by the perfectly organised business system of the United Fruit Company for obtaining their bananas, placing them upon the market, and meeting any rival banana shipments that we are firmly convinced that it would be impossible for this colony to compete against them by an independently established industry. They practically hold a monopoly of the banana industry, handling most of the bananas that find their way into the American and Canadian markets and controlling practically all the Gros Michel bananas that go to the United Kingdom and other European countries. Apart from the consideration of whether bananas could be grown satisfactorily in this colony, it was patent to us that without a contract with the United Fruit Company it would not be possible to market satisfactorily any bananas that we might produce, and that they were not prepared to offer us any hope that such a contract would be entered into. In fact such a contract would be, as we have already indicated, in direct opposition with the carefully thought out and deliberately adopted policy of the United Fruit Company.

"The delegation therefore is unable in the face of the results of the investigations which have led them to the above conclusions to offer to the Commission either any hope of or any inducement for the establishment of a banana industry in British Guiana either at the present time or in the near future."

A Hint.

The lateritic hill slopes which supply soils admirably suited for the cultivation of limes have not proved so suitable for the growth of Para Rubber as the lower lands have done. This is in accordance with experience elsewhere.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

Yields of Sugar-Canes: Crops of 1910.

Reports were received from 25 plantations as to their crops of Bourbon canes. The returns varied from 1.08 to 2.43 tons of sugar per acre, the mean return working out at 1.66 tons. Twenty-one of the plantations reported on areas of more than 20 acres each, the extreme yields on them being the same as on all the plantations, but the mean yield was 1.60 tons of sugar per acre.

Thirty-one plantations reported their results with D 625, and of these 29 estates reaped areas of more than 20 acres each of that cane. The extremes over all areas were .90 and 2.44 tons of sugar per acre, the mean being 1.77 tons. On the areas of over 20 acres each the extremes were 1.28 and 2.44 tons, the mean working out at 1.80 tons.

Twenty-three plantations reaped D 145 cane, its mean return on all areas planted being 1.76 tons of sugar per acre, whilst the mean return on 15 plantations where areas of more than 20 acres each were reaped was 1.78 tons. On the first of these the extreme yields were .84 and 2.32 tons per acre, whilst in the latter they were 1.12 and 2.19 tons.

Results were reported by 25 estates on B 208 cane, the extremes being .95 and 2.30 tons of sugar per acre whilst the mean worked out at 1.70 tons. Fourteen of the plantations reaped areas of more than 20 acres each of these canes, the extreme yields reported by them being 1.39 and 2.18 tons, whilst the mean yield was 1.81 tons of cane per acre.

D 109 was reaped on 27 plantations, 24 of which had areas of over 20 acres of it. The maximum return recorded was 2.24 tons of sugar per acre, the minimum of all returns being .61 tons, and those of large areas 1.15 tons. The means were 1.57 and 1.59 tons of sugar per acre, respectively.

Fifteen plantations had B 147 under cultivation, six out of which each had more than 20 acres of it. On all trials the extremes were .80 tons and 2.64 tons, whilst on the larger areas they were 1.21 and 1.98 tons. The mean yields were 1.54 and 1.61 tons of sugar per acre respectively.

The White Transparent cane was cultivated on 5 plantations, 4 of which had areas greater than 20 acres of it. Its extreme yields were 1.24 and 1.77 tons of sugar per acre, its mean yield on all the plantations being 1.56 tons, whilst on those reaping more than 20 acres each of it, it was 1.65 tons.

B 376 was the only other cane reaped on several plantations Thirteen plantations reported on its yields which varied from .90 to 2.53 tons of sugar per acre. Three plantations reaped areas of more than 20 acres of it, the extreme yields being .90 and 2.10 tons. The mean yield of all the areas was 1.57 tons of sugar per acre, that of the three plantations wa 1.62 tons.

The areas reported on of each variety on were :

Bourbon	12,827	acres.
D 625	12,538	,,
B 208	8,378	,,
D 145	3,317	,,
D 109	2,724	,,
B 147	705	,,
White Transparent	303	,,
B 376	170	,,

Many varieties were reported upon each of which had been reaped on a few acres only. The yields of the following were on areas of over 20 acres each.

No. of Estates reporting.		*Tons of Sugar per acre.*
1	Diamond 399	2.44
1	Diamond 185	2.31
2	D 4399	2.29
2	Green Transparent	2.24
1	D 74	2.23

Last year's experience confirmed earlier experience that certain of the new varieties, when cultivated over large and widely distributed areas, are capable of giving yields 12 per cent. in excess of that of the Bourbon.

AREAS OF VARIETIES SUGAR-CANE FOR CROPS OF 1911.

Reports have been received from 39 plantations which show that 37 plantations have 21,672 acres occupied by D 625, 32 plantations have 9,531 acres of B 208, 31 plantations have 4,382 acres of D 145, 32 have 3,261 acres of D 109, 15 have 754 acres of B 147, 4 have 495 acres of Green Transparent and 8 have 251 acres of White Transparent, whilst on two plantations 703 acres are occupied by Diamond 185.

The area occupied by D 625 is 5,022 acres in excess of that under cane for 1910, an increase of 153 acres only is shown by D 145

and one of 216 acres by Diamond 185, whilst the following varieties show decreased areas:

Variety.	*Decrease.*
B 208	105 acres
D 109	802 ,,
B 147	342 ,,
Green Transparent	89 ,,
White Transparent	106 ,,

The following varieties are also being cultivated in areas of over 100 acres each

Variety.	*Area.*	*Increase.*
B 376	194 acres	6 acres.
D 4399	140 ,,	27 ,,

45,385 acres are now occupied by canes other than the Bourbon, as compared with 41,004 during 1910, the increase being equal to 10.6 per cent.

The area occupied by the Bourbon cane has been reduced from 28,823 acres in 1910 to 24,252 acres for the crops of 1911. Thus 65 per cent. of the land on sugar estates which is cultivated in sugar-cane is now occupied by varieties of sugar-cane other than Bourbon.

RICE.

The returns received by the District Commissaries show that during the year 1910, 31,680 acres were cultivated in rice, the average yield being 608,250 bags of paddy or at the rate of 19.2 bags per acre. In 1909, 36,230 acres yielded 802,600 bags or 22.1 bags per acre. There was therefore in 1910 a falling-off of 4,550 acres and of 194,350 bags of paddy as compared with the returns of the previous year.

J. B. H.
F. A. S.

Cacao Experiments, 1910-1911.

During the years 1910 and 1911 the returns of cacao from the manurial experiment fields at Onderneeming Farm were as follow:—

CACAO, 1910 AND 1911.

Yields of Wet Cacao or "Pulp" Per Acre.

Plots.		Lbs. per Acre. *Yields.*	*Probable Error.*
Nos. 1, 4, 5, 11, 16	No Manure ...	2,470	±79
Nos. 3, 8, 13	Heavily Mulched ...	3,127	±210
Nos. 12, 18	Sulphate of Ammonia only	2,352	±188
Nos. 6, 14	Superphosphate of Lime and Sulphate of Potash ...	2,960	±143
Nos. 5, 10, 15	Sulphate of Ammonia and Superphosphate of Lime	2,803	±196
Nos. 2, 17	Sulphate of Ammonia, Superphosphate of Lime, and Potash	2,735	±77

The above returns are equivalent, on the assumption that the 'pulp" yields 36.6% of its weight of cured cacao, to the following:

Yields of Cured Cacao.

Plots.		Lbs. per Acre. *Yields.*	*Probable Error.*
Nos. 1, 4, 5, 11, 16	No Manure	904	±29
Nos. 3, 8, 13	Heavily Mulched ...	1,144	±76
Nos. 12, 18	Sulphate of Ammonia only	860	±69
Nos. 6, 14	Superphosphate of Lime and Sulphate of Potash ...	1,083	±52
Nos. 5, 10, 15	Sulphate of Ammonia and Superphosphate of Lime	1,025	±92
Nos. 2, 17	Sulphate of Ammonia, Superphosphate of Lime, and Potash	1,001	±28

Nineteen plots were limed in 1909 whilst 19 were not so treated. The limed plots produced during the two years mean yields of 2,800 lbs. of "pulp," equal to 1,025 lbs. of cured cacao per acre, whilst the not-limed plots produced mean yields of 2,720 lbs. of "pulp," equal to 996 lbs. of cured cacao per acre. Contrary to our expecta-

tion, the application of lime to the cacao fields did not produce any beneficial effects: the differences in the yields of the limed and not-limed plots being well within the limits of probable error.

The courses of treatment which, in this series of trials on the Onderneeming soils shows promise of financial success are the practice of heavy mulchings, manurings of phosphates and potash, and of phosphates and nitrogen.

A very interesting point is being noticed in connection with the trials of heavy mulchings. The rootlets of the relatively few shade trees (Oronoque= *Erythrina glauca*) on the Onderneeming fields where mulching has been practised are forming a dense felting through and over the mulch. The rootlets in this are covered with practically innumerable nodules. This mass will from time to time be trimmed from the main roots of the shade trees and will itself form an important addition to the mulchings

J. B. H.
F. A. S.
S. H. B.

Local Markets.

Whenever the "planting" or capitalist agricultural industry exists in a district, a very good local market is generally provided for anything that the peasant can produce of the same nature as that grown upon the estates. The villager can sell his own produce to the estate for cash. The great point to be attended to in this connection is that the produce be sold at an early stage of preparation, so that the estate can make it up into finished material as good as its own. The peasant has not in general the knowledge necessary to turn out a high grade of produce, but if he sells tea to the estate as leaf, rubber as milk, cacao as freshly cut pods, and so on, the estate can work these up into first class material. Very numerous native tea gardens in Ceylon, for example, exist. Each has an area of one to forty acres. It would be impossible to turn out a good grade of tea from such a small acreage, but the leaf is sold to the nearest big factory on a capitalist estate.

If a market can be found in this way, the progressive man need not be confined to crops which have a market in the country. He may, for instance, grow tea, rubber, or other crop for which the market is thousands of miles away, but if there is no capitalist industry, he must stick to crops for which there is a local market.

—"Tropical Agriculturist," (Ceylon), Dec., 1910,

Meetings of the Board of Agriculture.

A meeting of the Board of Agriculture was held in the Broad Street offices on Wednesday, December, 21; His Excellency the Governor (Sir F. M. Hodgson, K.C.M.G.) presiding. There were present the Director and Assistant Director of Science and Agriculture, the Hons. J. H. W. Park, F. Fowler, B. Howell Jones and R. G. Duncan, Messrs. J. Junor, J. Brumell, J. J. Quelch, J. Wood Davis, F.R., J. Monkhouse, J. Downer, O. Weber, W. M. Payne and T. E. Earle; with E. S. Christiani, acting Secretary to the Board; and the other officials.

His Excellency intimated that Messrs. O. Weber and T. E. Earle had been appointed members of the Board and referred in complimentary terms to the services of the former as Secretary.

A motion by His Excellency to record the appreciation by the Board of the services of Mr. O. Weber was seconded by the Hon. B. Howell Jones and carried unanimously: Mr. Weber suitably replying.

Prof. Harrison mentioned that it was proposed to appoint Mr. Christiani as Secretary and that Miss van Nooten should assist him in his clerical duties, an assistant typist relieving Miss van Nooten of some of that work.

RICE INSTRUCTIONS IN HINDI.

Prof. Harrison announced that the abstract of rice instructions, written in Hindi, had been prepared in accordance with the resolution of the Board at its last meeting, and had been sent to the Immigration Agents and posted up widely.

SEED BEDS FOR PARA RUBBER.

He also informed the Board that a leaflet on the preparation of seed beds for Para rubber was being prepared. About 500 copies would be issued.

THE "JOURNAL."

Prof. Harrison, commenting on the *Journal* of the Board, mentioned that he hoped to publish the results of current experiments with cane and other experiments as soon as they were available; and hinted that the sugar estates might become subscribers.

INFECTED RUBBER STUMPS.

The Director having announced that a shipment of rubber shoots from Ceylon was found to be infected with *Botryodiplodia elasticae*, submitted a recommendation from the Rubber Committee that rubber cuttings and stumps should be imported under strict egulations as in the case of sugar-cane. It was, he said, a matter of the utmost importance, when sta ting a new industry like rubber, to take every precaution from the very first to prevent the introduction of fungus and other diseases.

Consideration of the proposed restrictions was postponed in order that certain legal points might be cleared up.

PROTECTING BIRDS.

A recommendation of the Wild Birds Committee was submitted which proposed to extend the Ordinance to the capturing as well as the killing of some 570 kinds of birds within a radius of 10 miles from any plantation.

ESTIMATES FOR 1911-12.

The Estimates for 1911-12 were read and approved.

COMPULSORY PLANT SANITATION.

When discussing the appointment of an Economic Biologist, Mr. Duncan asked that the Board recommend the Government to provide for compulsion in dealing with plant pests. With regard to *Castnia licus*, some estates might take measures which would be rendered nugatory by the inaction of other estates ; and this suggestion was warmly supported by Mr. Howell Jones. Mr. Quelch insisted on the wide prevelance of *Castnia* on the sugar estates of the colony. His Excellency suggested that the matter be referred to the Plant Diseases and Pests Committee. After some discussion Mr. Duncan moved that the Board recommend the Government to give immediate consideration to the question of enacting legislation to provide for joint action being taken by agriculturists with a view of fighting insect pests and plant disease and that the Plant Diseases Committee be asked to submit details to the Government regarding the suggested legislation.

Mr. Howell Jones seconded and the motion was adopted.

SEEDLING CANES.

Prof. Harrison announced that they had distributed in round figures 195,000 cuttings of different varieties of canes. Among the most promising was 118 obtained from D 625 which had given an exceedingly heavy yield—150 tons of cane to the acre, or equivalent to about six tons of sugar per acre.

An application from the West Bank Farmers' Association for a grant-in-aid of a show in August, 1911, was referred to the Exhibitions Committeee.

SALE OF PLANTS.

Returns from the Stalls showed that at Georgetown, from April to November, 3,461 plants had been sold; at New Amsterdam 2,593; at Suddie 92; and at Pomeroon 1,047. There had been a marked increase throughout. It was intended to start a stall at Morawhanna, North West District, Prof. Harrison remarking that the stalls cost very little and were an efficient means of disseminating the plants among the people.

It was decided to limit the number of publications of the Imperial Department obtained to those for official purposes, leaving it to any individual who wished to get them for himself, Prof. Harrison pointing out that the colony now had its own *Journal* and it was not necessary to assist the Imperial Department any longer.

THE 1911 RUBBER EXHIBITION.

It was announced that a pamphlet on Rubber had been prepared by the Director and Assistant Director for the International Rubber Exhibition of 1911 to be held in London, and this had been approved by the Rubber Committee. Mr. Stockdale would represent the colony at the Exhibition.

SAPIUM JENMANI.

Mr. Stockdale reported on the experimental tappings of *Sapium Jenmani* at Bonasika. The experiments were not yet complete, but the results showed that the planting of *Sapium* could not be recommended if Para Rubber was available.

REPORTS.

The reports by Mr. J. F. Waby on the Victoria-Belfield and West Bank Agricultural Shows in August were laid over, and after discussion referred to the Exhibition Committee.

Prof. Harrison announced that a Committee of the Board had discussed the Polders Bill with a Committee of the R. A. and C. Society and had reported favourably. The Bill had been passed by the Court of Policy.

DEMERARA RUM AND ITS ADULTERATION.

The report of the Royal Commission on whisky and other potable spirits was laid over.

Prof. Harrison said he wished to draw attention to the fact that the Commission found that Demerara rum was largely adulterated in Great Britain with silent spirit from various sources and exported under fancy names to Australia and other places. Another interesting point was that the test prepared by the Committee of the Board, the Planters' Association and the Chamber of Commerce seemed to have been accepted in full by the Commission. And the Commissioners adopted the Committee's wording in their definition of 'rum.'

Some discussion ensued with regard to the alleged adulteration, and Prof. Harrison and Mr. Duncan were asked to draft a letter to the Government on the subject.

Mr. O. Weber was appointed a member of the Exhibitions and Live Stock Committees and Mr. Earle of the Exhibitions Committee, the Subsidiary Products Committee and the Plant Diseases and Pests Committee.

Prof. Harrison announced that the Stallion "Orestes" had been sold for $130. After some protest from Mr. Payne, it was decided that "Upwind" be offered for sale at the forthcoming annual sale of Live Stock. The purchase of a jack donkey was postponed. It was announced that the Oxford Down ram had arrived and was at the Botanic Gardens, and that the Canadian Department of Agriculture had practically made a gift to the Board of the Hereford bull. It had been arranged that a certificate from the Government or Municipal Veterinary Surgeon should be forwarded with cattle exported to Barbados from this colony. Mr. Raleigh informed the Board that no glanders existed in the colony at that time : and the meeting terminated.

At the meeting of the Board on Wednesday, April 12, His Excellency the Governor, as usual, presided, there being also present the Director and Assistant Director of Science and Agriculture, the Hon. B. Howell Jones, Dr. Egan, Messrs. J. Gillespie,

J. Wood Davis, F.R., W. M. Payne, O. Weber, J. J. Quelch, T. Earle, the Rev. F. C. Glasgow, E. S. Christiani (Secretary) and the officers of the Board.

The acceptance by Mr. A. Seton Milne, M.R.C.V.S., of an appointment as co-optative member on the Live Stock Committee was announced. The resignation of Mr. Howell Jones drew a warm acknowledgment from His Excellency of the valuable services of the retiring member and a promise from Mr. Howell Jones that he would again join the Board when he returned to the colony. Mr. Humphreys, of Pln. Non Pareil, was elected in Mr. H. Jones' place.

The appointment of the Economic Biologist was definitely announced. It was expected that the gentleman—whose name was not available—would arrive in the colony early in June.

COLONY WOODS FOR PUNCHEONS.

Prof. Harrison announced the failure of the experiments with certain colony woods for puncheon making. The most promising one—"Pyrowa wykee"—had been pronounced unfit to hold either 'wind or water.' The matter was referred to the Forestry Officer for further experiment.

IMPORTATION OF RUBBER STUMPS.

Prof. Harrison said that the question of the proposed restrictions on the importation of rubber plants, etc., had been submitted to the Law Officers, who approved of the notice as drafted by the Committee. As it might be difficult for the Government Botanist to get to the wharf when plants were landed, the phrase "or by an officer of the Department of Science and Agriculture delegated for that purpose" was added; and with that addition the proclamation was agreed to.

RUBBER FEES.

Some discussion arose on the subject of fees for the export of rubber; and on the motion of Mr. Wood Davis, seconded by Mr Earle, it was agreed to fix a registration fee of 12 cents.

THE RUBBER PAMPHLET.

His Excellency, referring to the pamphlet on "Rubber and Balata in British Guiana" laid on the table, congratulated Prof. Harrison and Mr. Stockdale very heartily on its excellence, and on the admirable way the pamphlet had been compiled. Mr. Stockdale was to represent the colony at the International Rubber Exhibition in London in June; a ready sale for the book was anticipated; and another thousand had been ordered. Mr. Howell Jones and Mr.

Wood Davis also joined in the congratulations, and the latter moved that the Board record on its minutes its thanks and appreciation to the compilers. Mr. Payne seconded and the motion was carried unanimously.

RAPID GROWTH OF HEVEAS.

Prof. Harrison stated that at Tuschen, 600 Para rubber trees, obtained from the Botanic Gardens in February, 1907, had attained full tapping size in four years. Many of them were over 20 inches in circumference.

RUBBER FROM PLN. NOITGEDACHT.

Mr. Stockdale submitted samples of smoked Para rubber from Pln. Noitgedacht, brought down the previous day by Mr. Hutson, who had lent him 36 lbs. for the Rubber Exhibition.

SEEDLING CANES.

Prof. Harrison submitted the returns of areas occupied by varieties of seedling canes for the 1911 crop, and the returns from seedlings and from rice in 1910.

RED RICE.

Mr. Stockdale drew attention to the occurrence of red rice in some parts of the colony. A rigorous selection of seed paddy on the part of growers was required. If growers would obtain their new supplies from the Board the red rice problem would soon be reduced to a minimum.

INSECTS PESTS.

Prof. Harrison stated that the Committee appointed to go into the question of an Insect Pests Ordinance had deliberated very carefully and had decided that something on the lines of the English Act was desirable. Each case should be taken on its merits and regulations framed to meet it.

Mr. Howell Jones advocated persuasion rather than force and commented on the difficulties which had been encountered in carrying out the English Act.

Mr. Stockdale remarked that if the Board of Agriculture in England had had an Ordinance in 1905 they might have stopped the gooseberry blight. It seemed desirable to have an Ordinance so that if the necessity arose they would have the power to make orders.

SALE OF ECONOMIC PLANTS.

The reports from the Stalls showed that 4,981 plants had been sold at the Georgetown stall; 4,912 at New Amsterdam; 2,150 at

Pomeroon ; and 362 at Suddie ; a total of 12,405 as against 7,500 last year—an increase of nearly 70 per cent. The sales at the Botanic Gardens during the year amounted to 91,116 against 37,705 last year. Although there had been an increase of 30,000 rubber plants, there had been an increase of 14,000 economic plants, or 70 per cent. The increased distribution, too, had been carried out with practically no increase of cost. About 10,000 coffee trees had been sold and about 8,000 cacao.

FARMERS' ASSOCIATIONS.

An unsatisfactory state of affairs was revealed by the independent reports of Messrs. Waby and Jacobs on the district Shows and Farmers' Competitions. The Board had proposed that, if accommodation could be found, the agricultural instructors should spend a month at a time in the districts. The Associations were not in close enough touch with the Board.

After some deliberation, the following Committee was appointed to confer with the officers of the different Associations : Prof. Harrison, Messrs. Wood Davis, W. M. Payne, T. Earle, S. H. Bayley, J. Junor, and the Rev. F. C. Glasgow. It was decided to give $120 each to the Buxton and Friendship and the West Bank Farmers' Associations and $50 to the model exhibits by the Board and $50 for school garden exhibits.

SALE OF LIVE STOCK.

Prof. Harrison reported that the annual sale of Live Stock by the Board realised $1,522 for Government Stock. The expenses were $156.32—practically the 10 % the Board thought should not be exceeded.

DESTRUCTION OF ANIMALS.

With regard to compensation for animals destroyed under the Contagious Diseases Ordinance, 1892, the Veterinary Committee suggested that the Government should draft regulations on the lines of the English Act : if animals were found, after slaughter, to be free from disease, compensation not exceeding £50 might be allowed for a horse : if diseased up to a limit of £25. The value of a mule might be assessed by the Veterinary Committee.

Mr. S. H. Bayley was appointed Deputy Chairman of the Board during his acting appointment as Assistant Director of Science and Agriculture : and the meeting terminated.

Sale of Live. Stock.

The annual sale of live stock under the auspices of the Board of Agriculture was held this year at Eve Leary and proved very successful. There was a large attendance, which included the Director and Assistant Director of Science and Agriculture, Mr. J. Hampden King, the Hons. B. Howell Jones and D. M. Hutson, K.C., Messrs. J. A. King, J. J. Quelch, H. Daley, J. Gillespie, J. L. Stoute, A. E. Bratt, S. H. Bayley and Thos. Flood. Mr. P. Wight was the auctioneer and disposed of the lots in businesslike fashion. In all 22 head of cattle, six buffaloes and a mixed lot of sheep and poultry were offered, in addition to the Government stallion "Upwind," by Cyclone out of Upstart, which had completed a useful term of service at the stud. This well-known animal was quickly knocked down to the Hon. D. M. Hutson for $220; his harness and saddle fetching an additional $19—a satisfactory total in the circumstances.

BULLS.

The best prices amongst the bulls were made by a 25 months old Shorthorn-Holstein animal, by de Soto out of an imported cow, which went to the Hon. D. M. Hutson for $57, and a 16 months old bull by de Soto from a Zebu cow, which fetched $71 (Mr. D. A. Peters.)

COWS AND HEIFERS.

The cows proved a considerable attraction, a 4½ year Shorthorn-Zebu going to Bhoney Persaud at $89 and a similarly bred beast to Mr. J. A. King at $63. Mr. Flood purchased two imported Holstein cows, 9 years old, for $51 each, and Mr. Bratt a Shorthorn heifer, 15 months old, by de Soto out of a cow by Royal Gloster, for $32.

BUFFALOES.

A brisk competition sprang up over the Buffalo heifers, Ramjohn purchasing three, 18 months old, 12 months and 10 months, for $45, $30 and $36 respectively; and securing an 18 months old bull for $27.

PIGS AND SHEEP.

A sensation was caused by a three-quarter bred Berkshire boar, six months old, which ran Mr. Cecil Morris into $34 before he became the owner. Other pigs went for $16 and $15, and a nice looking lot of sheep realized from $10.50 downwards.

Reviews.

THE RESIDUAL EARTHS OF BRITISH GUIANA COMMONLY TERMED "LATERITE,"

by

Prof. J. B. Harrison, C.M.G., F.G.S., F.I.C.,

Assisted by K. D. Reid,

Published in the Geological Magazine Dec. V, Vol. VII, Oct.-Dec., 1910, and Vol. VIII, No. III, March, 1911.

Originally applied by Buchanan in 1807 to an Indian formation, the term "laterite" has been extended by many authors and mining engineers, and recently by Prof. Harrison, Dr. du Bois and other geologists to include certain of the residual earths of British Guiana and its neighbourhood, derived from the gradual decomposition *in situ* of igneous rocks. This wider meaning was disputed by a reviewer of Prof. Harrison's "Geology of the Gold Fields of British Guiana" in the Bulletin of the Imperial Institute and led to a correspondence between Mr. J. B. Scrivenor, Geologist to the Malay States, and Mr. T. Crook, of the Imperial Institute staff, in which the latter maintained that this use of the term 'laterite' as understood by technical geologists, mining engineers and tropical agriculturists was unscientific and wholly unwarranted. In these papers, fortified by 30 detailed analyses of B. Guiana 'laterites' obtained locally, Prof. Harrison establishes his position and justifies his use of the term.

The history of 'laterite' is of some interest. Primarily the term denoted a rock characterised by a brick-like hardening on exposure. The discovery, made nearly a century subsequently, that the rock contained large amounts of hydra ed alumina, supplied a sort of secondary definition; and many ingenious theories were elaborated to explain the phenomenon of laterization. Bacteria were even credited with being the causal agents. Prof. Harrison demonstrates that as regards the formation of laterite the action is simple, consisting only of such changes as could be produced by the long continued action of percolating water. Taking a boulder of unaltered diabase from a long-deserted quarry near Christianburg on the Demerara River, the Professor describes its condition:— central parts ideally fresh, outer parts decomposed into 'laterite'; those outer parts divisible into an outer red one, apparently an ordinary ferruginous laterite and an inner one buff-coloured

with whitish spots in it, in actual contact with the unaltered rock. The crusts, at first quite soft, hardened in characteristic 'laterite' fashion after a few days exposure. Detailed analyses of all these parts of the rock were made, and the proximate mineralogical compositions calculated. The results are summed up thus: "The action (of water) has taken place above the water-table, and the removal of combined silica from the bases present has been very complete; as far as analytical determination show, none of it having been retained in combination as kaolin. The outer crust differs from the inner one by its lesser contents of the iron oxide and their lower state of hydration, and to a slight extent by the lower hydration of the aluminium hydrate. If by continued action of water containing readily oxidizable organic matters the iron oxide, other than that present in ilmenite, of the outer crust were removed, a laterite containing over 70 per cent. of aluminum hydrate would result." Thus simply we have the whole story. The cause of the hardening or setting of certain laterites will, in the author's opinion, not be found by chemical analysis. His personal opinion is 'that it is due in part to changes in the degree of hydration of the hydrated oxides of iron and aluminium present and to the gradual conversion of soluble colloidal forms of alumina, of iron peroxide, of silica and possibly of certain silicates, into insoluble modifications during the exposure of the rocks to the atmosphere. The deposition of the hydrated oxides of iron from the dissociation of naturally produced solutions of carbonate of iron is doubtless in many places also a factor in the induration of the laterite *in situ*'.

Locally the action of laterization is of great interest both to agriculturists who desire to pursue their vocation in the interior regions of the colony and to seekers after gold. The intensity and completeness of the changes wrought by it are remarkable. Rocks similar to the "greenstones" of the interior in more temperate climates usually weather to fairly or even very productive red loamy soils. In the Tropics these rocks change to aggregates of free alumina, limonite, some kaolin, varying amounts of titanium oxide and free silica; the mineral constitutents—lime potash, magnesia and phosphoric acid—which enable soils to be permanently productive being more or less completely elutrated from them. The lateritic earths are, as a rule, very porous, frequently of great depth, and red or ochreous in colour and are covered, especially after denudation from forest growth, either by ironstone gravel or by quartz sand. The laterite contains either quartz in blocks, quartz in veins or quartz as more or less finely divided, sharply angular sand; but in many places the

laterite contains very little quartz. Vast areas of more or less unproductive earths of this description occur in India, Ceylon, Malaya, the West Coast and other parts of Africa, Madagascar, and Brazil as well as in the Guianas. In a recent letter to the Director of Science and Agriculture Sir Daniel Morris wrote " I came across plenty of laterite in Ceylon and very unpromising and intractable material it was for agricultural purposes. It was possible in some districts, however, to bring it into account for growing tea. The iron in it seems to suit the tea plant ; but it was poison to coffee." Fortunately for this colony, there are very strong indications that, like tea in Ceylon, limes here grow well on the lateritic soils of the interior.

The laterization of the rocks whereby the combined silica is set free in a soluble state capable of traversing the mass of the laterite and into or through other porous or open rocks and of redeposition as quartz in veins, lenticular masses, or coarse gravel is, as has been shown in several of the Departmental reports and works on the geology of the goldfields of this colony, of great importance to miners and prospectors. It is this action which in some districts of the colony has caused the concentration of the gold originally diffused in very minute quantities through the rock into the paydirt of certain placers and has resulted in the production, where conditions have been favourable, of auriferous veinlets of quartz traversing the laterite and some of the schists and in the secondary enrichment in gold of certain so-called " quartz reefs " and of mineralised masses such as the aplite of Omai.

FOREST RESOURCES OF THE WORLD.

By Raphael Zon, Chief of Sylvics.

(Issued by the United States Department of Agriculture. Forest Service. Bulletin 83.)

An instructive and interesting publication in which an attempt is made to sum up the forest resources of the World, for comparison with those of the United States of America, " in order to determine the extent to which the United States can depend in case of exhaustion of its own timber."

The various countries of the world are separated into two groups, those whose wood exports exceed their imports, and those whose wood imports exceed their exports. In the former group there are ten countries, the principal ones of which are Austria-Hungary,

Canada, Sweden, Russia, Finland, Norway, Japan and the United States of America ; and in the latter the following may be mentioned : —the United Kingdom which buys nearly half the total exports of all the countries of the globe, Germany, France, Belgium, Spain, Italy, Holland, Denmark, Australian Commonwealth, West Indies, and British Possessions in Africa. Comparisons of different countries are made and deductions drawn on the following three common factors, *viz* :—

(1) the forest area,

(2) the annual growth, and

(3) the annual cut.

Detailed tables as to the area of forests, ownership, composition, yield, wood prices, annual growth, exports and imports, etc., are given in the case of those countries that are most highly developed. The forest resources of Germany, on account of her excellently organised forestry system, are most fully treated ; and those of the United States are specially detailed for the purpose of comparison with those of other countries.

The United States are found to occupy the second place among the nations of the world as to the extent of forests, Russia (European and Asiatic) coming first, and Canada third.

Those countries are first considered "whose natural resources have been more or less fully explored, and whose forests yield quantities of materials in common use which can be delivered at a low price to a market." All other forest regions are discussed under continents and treated in a general way.

" The forests of the rest of the world," it is stated, " may be and are botanically rich in species, but do not have great commercial value because they lack the kind of woods needed in commerce and industry by the 250,000,000 people composing the most advanced and powerful nations of Europe. The richest forests commercially, in Europe, are those of Sweden, and yet botanically they are very poor, containing, but two principal species, Scotch Pine and Spruce."

Amongst other matters of interest we are informed that " the forests of China are practically unknown ; Persia is almost treeless ; next to East India, Ceylon is the most heavily wooded Asiatic possession of Great Britain ; that 9 per cent. of the forests of the Straits Settlements have been declared reserved State forests ; that in Australia, forests in the European sense are very seldom met with ; that the forests of Africa are yet very little explored ; that

in Mexico the forest area of commercially valuable timber is estimated to be 5.1 per cent. of the land area ; and that in Central America there are extensive forest areas which are so little explored that there are no data as to their extent or volume."

In the short concise account of the forest resources of South America, the following extracts are of special interest as they come nearer home. "With the exception of the prairies of Uraguay and Argentina, most of the continent is covered with forests. The cutting has not yet impaired their value, because, firstly, the countries of South America are very thinly settled ; and secondly, which is more important, there are comparatively few rivers suitable for transporting timber to the coast. *Not a single State has made any forest survey, nor has any clear idea of its forest resources.* Venezuela is for the most part a prairie. Its most extensive forests are found in the lower course of the Orinoco River. Columbia, though partially a prairie State, possesses more forests than Venezuela. The northern part of Chili has no forests. The forests of Brazil cover an area equal to one half of Europe. Guiana is relatively just as rich in forests as Brazil, especially British Guiana, which has the advantage of four large rivers, which with their tributaries are very suitable for floating logs. For this reason the exploitation of these forests has advanced further than in any other part of the country."

It is predicted that "for many years South America will continue to export hard woods, dye woods, etc., and import lumber and construction material. Eventually as the countries develop, the great forests now inaccessible will be opened up, and should supply home consumption which will have increased greatly by that time."

In addition to the purpose for which it was intended this bulletin affords a useful and ready means for comparing the timber industries of the world.

C. W. A.

RUBBER AND BALATA IN BRITISH GUIANA.

By Professor J. B. Harrison and Mr. F. A. Stockdale.

Pamphlets on the Colony's Industries.

With the praiseworthy idea of putting British Guiana well to the front at the International Rubber Exhibition to be held in London next June and July, the Department of Science and Agriculture have published an excellent book on "Rubber and Balata" in this colony. The title page bears the names of the Director and Assistant Director, and quite a sensation has been caused locally by the publication : the general consensus of opinion being that nothing

approaching the booklet in style or matter has as yet been issued on behalf of the colony. The data given have the merit of being official, and therefore will carry immense weight with those interested in rubber, and the information is so concisely set out, so clearly arranged and so daintily presented, that even those not concerned in the rubber business must be attracted. As an all round advertisement the book is indeed hard to beat. The capital series of photographs will give Londoners a very fair idea of the conditions obtaining in rubber centres in this colony: some of the balata pictures are most striking: and the maps, which have been printed under the supervision of Mr. C. Wilgress Anderson, are neat and reliable. It is to be hoped that the book will shortly be obtainable in the colony: many here will be anxious to obtain it. Professor Harrison and his able lieutenant have deserved well of the colony in this matter, and deserve hearty congratulations on a remarkable publication.

The pamphlets, six in number, deal concisely with Sugar, Rice, Cacao and Coffee, Coconuts and Limes, Balata and Rubber, and the Timber Industry; and in all the history, present condition and future prospects of the product dealt with are neatly summed up and set out. An immense amount of information—and work, we may add—is compressed into a handily small space, and these little booklets should prove invaluable as a means of "advertising' the colony in the best sense of that much abused term. The Permanent Exhibition Committee may be warmly commended for its enterprise, and their Secretary on his excellent work. More than a word of praise is due to the *Daily Chronicle* Office for the workmanship. Book and pamphlets are beautifully printed and artistically bound and it is safe to predict that no other colony will be able to show a better local production on its stall at the International Rubber Exhibition of 1911.

Self-Help.

But, in looking into the causes of the unsatisfactory condition of our fields, we ought not to blame Providence or the Government only, as so many are inclined to do, but we must also ask ourselves whether we have done everything in our power to relieve our own situation and find a remedy for our present afflictions. Those who believe that the Government or Divine Providence will do everything deceive themselves. They must attain salvation by means of their own efforts, and above all in combined efforts.

—The Hon. Rafael Palma in "The Philippine Agric. Review," April, 1910.

Hints, Scientific and Practical.

Ferns and Fungi. The maidenhair ferns were affected in April by a fungus that killed out the leaflets. Every effort to prevent its spread was without avail, and therefore all the ferns were cut down and repotted in clean pots and new soil. The fern-house was thoroughly scrubbed, sprayed with Bordeaux mixture and then scrubbed again.

The ferns, on account of wet weather, grew slowly at first but subsequently sent up strong, healthy shoots, and made excellent growth. There has been no recurrence of the fungus trouble.

—F. A. Stockdale, B. A., F. L. S. (Government Botanist), in Report of Department of Science and Agriculture, British Guiana, 1909-10.

Uniformity in Tobacco. Uniformity in the shape, size and texture of the leaves and in the time of ripening is of the greatest importance in tobacco cultivation. Unless the crop ripens off uniformly, the difficulties and expense of harvesting and curing are increased. A crop made up of several types of plant differing in the size, shape, venation, texture and thickness of the leaves does not give a uniform product and unnecessary expense is involved in sorting out the various grades for market. The production and maintenance of the uniformity of the leaf is therefore a matter of the first importance, and is, moreover, the first condition of the improvement of the tobacco crop in India.

This improvement can only be maintained by the prevention of natural crossing and by raising all seed under bag. Where a large number of varieties are grown at an experimental farm, the greatest care will have to be taken to keep the types pure and to prevent intercrossing.

—A. Howard, M.A., F.L.S. in "Memoirs of the Department of Agriculture, in India," Oct., 1910.

Soot as a Manure. The value of soot as a manure depends upon the ammonium salts which it contains, as well as upon its beneficial effect on the texture and colour of the soil, and its power of diminishing the ravages of slugs and small snails upon a young crop. In various samples which from time to time have been submitted to analysis the percentage of nitrogen present has been found to vary within very wide limits from 0.5 to

7 per cent., and it is usually stated to be present in the form of ammonium sulphate ; actually it occurs for the most part as ammonium chloride.

Amongst samples taken from dwelling-houses, no relation was found between the nitrogen content and either the excellence of the draught in the chimney or the percentage of ash in the soot.

The dust of a characteristic reddish colour from a tall boiler chimney was found to contain only 0.5 per cent. of nitrogen and 75 per cent. of ash. A reddish colour in itself however is no indication of a low nitrogen content, since soot from a kitchen chimney with 5.4 per cent. of nitrogen had a distinctly reddish tinge.

The dust from the Cambridge Rubbish Destructor, similar to that from the London Destructors used extensively upon the hop-fields of Kent, contained no nitrogen and was composed almost entirely of inorganic matter, mostly oxides, of aluminium and iron with calcium carbonate.

A sample of soot consisting of flakes of tarry matter from a wood fire was found to contain 6.4 per cent. of nitrogen, a distinctly high value.

It has been generally accepted by farmers that a light soot is the best ; this is well borne out. This points to the conclusion that soot should be bought by volume and not by weight, for then the buyer is more likely to get an approximately constant quantity of nitrogen per bushel. Further if soot has been adulterated with ashes or grit this will have less effect upon the volume than upon the weight.

Nitrogen in the form of readily available plant food is worth about sixpence a pound, hence a bushel of fresh light soot is worth about a sixpence from its fertilising value alone, regardless of its beneficial action upon the soil and its special power of deterring the visits of insect pests.

—H. W. Harvey (School of Agriculture, Cambridge) in " The Journal of Agricultural Science," December, 1910.

" Burning ": Pro and Con. The burning of the stubble destroys a few weed seeds, but, at the same time, the warmth and the resulting ash favour the germination of any hard seeds present in the soil and also provide precisely those conditions which aid in the spread of fire weeds, some of which easily become troublesome. It makes the impoverishment of virgin soils cropped without manuring take place more rapidly than would otherwise be the case, and it does this without producing any commensurate increase in the crop to compensate for the loss of the capital stored in the soil in

the form of nitrogenous plant-food while it was in a virgin condition. It is the act of a spendthrift to burn away in a year or two the capital which was accumulated for him by nature without any effort on his own part, and which might, when properly husbanded, have lasted him his whole lifetime.

The use of fire to clear the ground in preparation for cultivation is common among all savage races who practise a more or less rudimentary kind of agriculture, but with the scientific advance of of agriculture fire plays less and less part in its daily doings. Even in a garden, the less the amount of "rubbish" that is burnt, instead of being rotted wherever sufficiently soft and free from weed seeds, the less the amount of manure that will need to be carted in to keep up its fertility. Precisely the same thing applies on a large scale, and to an even greater extent, to agriculture.

—A. J. Ewart, D. Sc., Ph. D., F.L.S., in "Journal of Agriculture," Victoria (Australia), Vol. VIII, Pt. 10.

Aphides or "Plant Lice."

Nearly all plants, both in garden and field, and under glass, suffer from the ravages of Aphides. These universal pests are most common in temperate climates but even in the tropics whole crops are ruined by them. Aphides are known by a variety of common names, such as Plant Lice, Green or Black Fly, Smotherers, or Dolphins, while the disease they cause is sometimes termed "Blight."

Aphides are soft-skinned insects with antennæ generally longer than the body. When wings are present they are delicate, with few veins. On the upper surface of the abdomen two tubes are generally present—sometimes short, sometimes long—from which a liquid can be discharged. The mouth parts are fitted for piercing and sucking; the plant tissues are first pierced and and then the sap is drawn away. The skin of plant-lice is provided with glands which secrete a waxy or mealy substance or woolly masses which have the power of throwing off water.

The young differ little in form from the full-grown insects, and their feeding habits are the same.

Development from the young stage to adult takes a very short time, and hence multiplication of individuals is rapid. Dry, hot weather is specially favourable for Aphides.

The summer generations of Aphides are produced without the presence of males, and the females may be wingless or winged, both conditions being found in the same life-history. The winged generations spread the infestation. These females—wingless and

winged alike—can give rise to live young, and this power of viviparous multiplication and the appearance of winged forms are to be associated with abundance of food at certain times of the year. As the cold part of the year comes males as well as females are produced and fertilised eggs are laid.

Some Aphides confine themselves to one species of plant, others migrate so that part of the life-cycle is spent on a plant of a different species. Migration of the same kind of Aphid may take place to a number of quite unrelated species of plants.

Aphides damage plants in two days: (1) by sucking away the sap and so weakening the plant, and (2) by their excrement falling on the leaves and clogging the stomata and so interfering with gaseous interchange. Further, the excrement, consisting partly of a sweet gummy substance called "honey-dew," is a favourable germinating medium for the spores of some fungi, and spoiled sooty-coloured patches show on twig, leaf, and fruit.

Natural Checks.—Several insects prey upon Aphides, and should be encouraged. The chief of these are Lady-birds and their larvæ (*Coccinellidæ*) Hover-fly larvæ (*Syrphidæ*); and the larvæ of the Lace-wing Flies (*Chrysopidæ*). Various minute Hymenopterous parasites (*Chalcididæ*) lay their eggs in the bodies of Aphides, those parasitised being destroyed. Man cannot, however, rely solely on the services of these beneficial insects, but should check the increase of the Aphides by washes as soon as they appear upon his plants.

—"Journal of the Board of Agriculture" (England), Jan., 1911.

Vegetable Proteins. Proteins are found in the living parts of all plants. They occur in the dissolved state in the circulating fluids and in the solutions of the cell vacuoles, that is in the cell sap. In a semi-dissolved state they occur in the protoplasm, and in the undissolved state as reserve protein in the cells of seeds, tubers, bulbs, buds and roots.

In many of the cells of these parts of the plant the undissolved protein is found in the form of well-developed crystals of various forms, formerly called crystalloids; in irregular, semi-crystalline forms with faces and angles on a part of their surface, and as regular or distorted spheres, all of which several forms are found in aleurone grains; and in an amorphous, finely granular form, generally designated aleurone. The reserve protein occurs in the cells together with the non-nitrogenous reserve food materials, starch, oil, etc., which several substances fill the cells, leaving a thin layer of dried protoplasm between them and the cell wall.

In most monocotyledonous plants the cells of the endosperm and embryo occupy distinct parts of the seed.

The tissues of the endosperm of such seeds when fully ripe are, therefore, made up of cells which are almost entirely filled with the reserve food substances, since the thin layer of protoplasm next to the cell wall forms a very small part of the contents of the cell. The tissues of the embryo contain protein associated with a greater variety of substances than are present in the cells of the endosperm, and are also rich in nucleated cells, in which much of the protein apparently exists in the chromatin substance of the nuclei in special forms of combination with nucleic acid which are generally known as nucleoproteins and nuclein. In this part of the seed the chemical conditions are therefore more complicated than in the cells of the endosperm, since the metabolic processes of the embryo apparently require a greater variety of substances than exist in the cells of the endosperm of the fully ripe seed, whose chief office is to supply food to the subsequently developing embryo. That this variety in the nature of the constituent substances is shared by the proteins of the embryo tissues has been shown by studies of the protein constituents, of the wheat embryo....In most dicotyledonous seeds the cells containing the reserve protein are distributed among those of the embryo tissues.

In roots, bulbs and tubers the undissolved reserve protein occurs suspended in the cell sap frequently in the form of crystals.

Little that is definite is known concerning the chemical properties of any of the plant proteins, except those of seeds, for the proteins occurring in the physiologically active cells and fluids of plants have been but little studied, owing to the relatively small quantities in which they occur and the difficulty of separating them from each other.

T. B. Osborne, Ph.D.: in "The Vegetable Proteins."

For Buyers of "Artificials."

Apart from lime, which may be purchased at from 10s. to 18s. per ton in most localities, there are three constituents, and only three which should be taken into consideration in arriving at the value of artificial manure, viz., nitrogen, phosphates, and potash. These are the constituents which an artificial manure is intended to supply to the crop, and any statements as to its value in other directions should be ignored.

—"Journal of the Board of Agriculture," (England), No.v., 1910.

The Compositions of Local Rices.

The yields of the different varieties of rice under cultivation at the Experimental Fields of the Botanic Gardens during the summer and autumn of 1910 were recorded on page 107 of the number of this *Journal* for October, 1910. Samples of the more important varieties have been examined at the Chemical Division of the Department of Science and Agriculture by the Assistant Analyst (Mr. J. Williams) and Mr. S. Man-Son-Hing. The results of the analyses made were as follow :—

Variety.	No. 3.	No. 4.	No. 6.	No. 75.	*Creole*	*Berbice Creole.*
Weight in lbs. per bushel	48.5	50.5	51	50.2	49	55
			Proximate Compositions.			
Water	13.2	11.7	12.1	13.1	13.6	12.0
Fats	2.2	2.8	2.8	2.3	2.2	2.4
1 Albuminoids ...	4.2	4.3	3.5	3.8	4.2	4.4
2 Amides, etc. ...	2.0	2.8	2.8	2 8	2.3	3.1
Saccharose	*traces*		*traces*	*traces*		*traces.*
Glucose	·06	·06	·05	·05	·05	·05
"Gums"	2.6	2.7	2.2	2.2	2.5	2.3
Woody fibre ...	6.9	7.2	6.7	8.6	7.5	7.6
Digestible fibre, etc....	8.4	10	10.8	9.5	9.5	2 7
Starch ...	55.0	52.9	53.6	52.3	52.9	60.8
3 Mineral Matters ...	5.5	5.6	5.5	5.4	5.3	4.7
	100.06	100.06	100.05	100.05	100.05	100.05
1 Nitrogen ...	.67	.68	.54	.60	.67	.70
2 ,, ...	.32	.45	.46	.44	.36	.49
Total Nitrogen ...	.99	1.13	1.00	1.04	1.03	1.19
3 Insoluble matter ...	5.1	5.2	5.4	5.1	4.8	4.2
Silica ...	4.0	4.1	4.3	3.8	3.8	4.0
Soluble matter ...	.4	.4	.1	.3	.5	.5
Potash ...	.19	·20	·22	.18	.17	.14
Phosphoric anhydride ...	.64	.67	.59	.55	.57	.62

From the above figures it is evident that as regards composition the Berbice Creole is the best rice. Where there are fairly wide variations in the percentage of starch present in varieties of rice it appears that some guide to their value may be obtained from their

relative weights per bushel, and that the determination of such weights should be an easily applicable mode of ascertaining the relative quality of various kinds of rice.

J. B. H.
F. A. S.

Modern Methods.

Every rubber tree on the estate must be suspected of being diseased, and inspected accordingly.

Each rubber tree is to be treated as if it were the only tree on the estate. The argument put forward for the utmost well-being of each individual rubber tree applies with still greater force to each individual coolie on the estate. No expense or trouble is too great that will ensure a well-housed, healthy and contented labour force.

Quinine, 10 grains in solution, should be given to every working and non-working coolie three mornings every week at muster roll...If there are many cases of malarial fever on the estate, mosquito curtains, good large ones capable of holding a married couple or two or three single men, should be insisted on.

"Instructions to Managers and Assistants on Rubber Estates" : Agric. Bulletin, F.M. Straits : Sept. 1910.

The Farmer and Technical Education.

A Co. Waterford farmer contributes an interesting note to the Dublin Farmers Gazette on "How Technical Knowledge Helps the Farmer." Fifty years ago, he says, it was possible for a farmer to conduct his business in a fairly satisfactory manner with very little more education than could be obtained at a National school and on his farm. At present, however, this is not the case—a farmer may be a most excellent ploughman, may be expert in the art of stacking and thatching ; may be fully at home in all the details of the practical side of farming, and yet may lose money daily on account of his want of knowledge of "technical agriculture." His skill in ploughing will be of little aid to him when he tries to value his manures according to their analyses ; the neatness of his thatching will not avail when he is considering the percentage germination of his grass seeds. We thus see that, all important as is good practical knowledge and experience, something more than mere practical knowledge is required in this twentieth century.

Editorial Notes in "Natal Agric. Journal," Sept., 1910.

Visits to Country Districts.

ONDERNEEMING.

The Director, accompanied by the Agricultural Superintendent, paid a visit to Onderneeming Experiment Station. The cultivation here is in very satisfactory condition and marked progress is being made by the plots of limes that have recently been planted. The lime nurseries were also looking very well. It was decided to continue the planting of *Hevea brasiliensis* in the old coffee fields, the plants raised from local seed being planted alternately with those raised from imported seed.

The Assistant Director has also visited Onderneeming and commenced tapping operations on some of the largest trees. Half herring-bones on quarters of the trees and two half V's on those trees with a girth measurement greater than 18 inches but less than 20 inches are the systems that have been adopted.

ISSORORA.

The Director, Assistant Director and Agricultural Superintendent have visited the Issorora Experiment Station and the principal rubber-growing properties in the North Western District. The weather in this district has been excessively wet during the year and on the more pegassy soils the growth of Para rubber has not been so rapid as on those soils in which a good admixture of clay exists. At the experiment station the growth of the Para rubber trees has been satisfactory and marked progress has been made on some of the estates. Sapium rubber continues to grow well, and light tappings have been commenced at David Young's Estate and at Pln. Rubberton. It has been decided to cut down the forest growth in sections A., B., and C. at the Experiment Station and to replant when cleared with Para rubber and with *Sapium Jenmani.* The first 10 acres of the new extension have been planted up and a further 10 acres have been cut down. The seeds obtained from the young Hevea tree that fruited at Pln. Rubberton have not grown. More seeds are now being formed on some of the young trees.

PLN. NOITGEDACHT.

The Assistant Director has visited Pln. Noitgedacht in connection with the tapping of Para rubber. A fine lot of good quality rubber has been obtained.

ESSEQUIBO AND THE EAST COAST.

The Agricultural Superintendent has visited the lower Essequibo district and also Pln. Windsor Forest. Visits have also been paid

to the village lands at Buxton, and a general report on the condition of the cultivation of those lands have been submitted.

FARMERS' COMPETITIONS.

The judging of the lower East Coast Farmers' competition has been carried out by the Head Gardener and Agricultural Assistant McWatt. The best cultivated lots were at Triumph, but a large portion of the cultivation of the older lands of the villages was in a neglected condition. The plots entered in the West Bank Farmers' Competition were judged by the Assistant Gardener and by Agricultural Assistant McWatt.

F. A. S.

Coconuts in British Guiana.

The area under coconuts has been considerably increased. Unfortunately pests and disease are prevalent in some districts, recommendations made for their alleviation having been acted upon by very few cultivators. The neglect and overcrowding frequently evident in the areas planted with coconuts is undoubtedly a potent cause of most of these evils. In the Pomeroon district much harm is being done to coconut plantations by the lands aback being devoted to rice cultivation, their dams being often defective with the results that the coconut palms suffer very severely from repeated and long continued flooding with water, seepage through the dams.

—Report of Department of Science and Agriculture, British Guiana, 1909-10.

To Treat Fungus Disease.

Remedial treatment consists, in practically all mild cases, in cutting out the part affected together with a good margin of sound tissue—the edges of the cut being left very clean. In more severe cases the plant or tree should be cut down, and when the roots are affected the stump, with as much of the roots as possible, should also be extracted. The hole from which the roots have been removed should be left open to the action of the sun for a considerable time. As a further precaution, a trench should be dug around the affected area and quicklime applied. Diseased plants and portions of plants removed in this way should invariably be destroyed by fire. Exposed surfaces of wood should be protected from fresh infection by a coating of tar.

—"Tropical Agriculturist" (Ceylon), Dec., 1910.

The Model Gardens.

RECORD OF ATTENDANCES.

Below is given a table setting out the number of pupils who attended the Model Gardens of the colony, arranged in quarterly periods from April 1, 1907:—

	Bourda.	Charlestown.	Belfield, E. Coast.	New Amsterdam, Stanleytown,	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Total Attendances.
1907									
April 1 to June 30	305	337	412	329	12	...	...	...	1,395
July 1 to Sept. 30¶	381	298	202	285	256	...	...	...	1,422
Oct. 1 to Dec. 31	575	293	380	221	288	...	...	...	1,757
1908.									
Jan. 1 to Mar. 31	597	731	389	299	187	...	...	...	2,203
April 1 to June 30	1,438	860	183	274	243	...	...	...	2,998
July 1 to Sept. 30¶	1,698	976	440	199	212	...	...	...	3,552
Oct. 1 to Dec. 31	1,714	819	465	115*	411†	160‡	...	...	3,684
1909.									
Jan. 1 to Mar. 31	1,638	710	338	463	370	302	...	...	3,821
April 1 to June 30	1,707	677	329	142	288	446	...	...	3,589
July 1 to Sep. 30¶	1,252	742	433	436	172	378	223‖	...	4,636
Oct. 1 to Dec. 31	1,876	536	438	236	362	771	439	...	4,858
1910.									
Jan. 1 to Mar. 31	1,282	769	287	370	259	489	465	..	3,921
April 1 to June 30	1,311	558	787	894	303	455	519	403§	5,240
July 1 to Sep. 30¶	1,234	526	910	748	294	510	498	537	5,257
Oct 1 to Dec. 31	1,209	444	1,285	336	295	493	502	592	5,156
1911.									
January to March 31	1,086	360	1,042	838	312	514	414	572	**5,695

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable full records of the very numerous attendances during his absence.

* Schools in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.
¶ Schools in vacation during August.
‖ Instruction commenced in July.
§ Instruction commenced in April
** Including 557 who attended the new garden in Wakenaam, where instruction commenced in January.

Answers to Correspondents.

AN INSECT PEST OF PIGEON PEAS.

Mr. A. A. Abraham, Agricultural Instructor, Pomeroon District, sends specimens of a skipper butterfly, identified at the Museum as *Eudamus* aff. *proteus*, the larvæ of which, he says, are very destructive to young plants of pigeon pea (*Cajanus indicus.*) Accompanying the specimens he sends the following notes :—

Larva.—When newly-hatched it is yellowish green in colour with an almost black head, but when fully grown it becomes more markedly green with a black dorsal line running longitudinally and two reddish coloured longitudinal lines. The black central line fades as the larvæ become old. The head becomes horny and is brown in colour ; immediately behind the head are two transverse black bands.

Pupa.—About 1 inch in length, of a light brown colour, attached by fine threads to the leaves of the plants. This stage lasts about 12 days.

Imago.—The adult measures from 2-2¼ inches across. They are dark brown in colour, and the anterior wings are marked by four large irregularly rectangular yellow spots with four smaller spots near the anterior margins—those of them being near the angles of the wings. The posterior wings are uniformly brown, extended posteriorly into two long "tails" that measure about 1 inch in length and $\frac{3}{16}$ inch across. The posterior margins of these wings are fringed with light greyish brown. The under surfaces of the posterior wings are spotted with dark brown spots separated in some places by streaks of a light greyish brown. The adults fly by day.

The larvæ attack apparently only young plants and feed in the early part of the day and during the late afternoon. They join together the margin of the leaves by fine threads and rest in these shelters during the heat of the day.

The remedial measures suggested are hand-picking, dusting the plants with Paris Green or spraying with arsenate of lead.

F. A. S.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to March 30 (1911). The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1908	1909 Jan. 1 to March 30.	1910	1911.
Sugar, tons ...	22,544	27,099	20,000	13,866
Rum, gallons ...	323,243	607,135	575,652	331,639
Molasses, casks ...	44	57	445	179
Cattle-food, tons ..	1,085	2,379	2,131	2,020
Cacao, cwts. ...	55	20	118	59
Citrate of Lime, cwts.	—	3	70	—
Coconuts, thousands	97 6	134·5	115·5	216
Copra, cwts. ...	—	123	65	425
Coffee, cwts. ...	—	600	344	269
Cotton, lbs. ...	12	—	—	—
Fruit, brls. and crates	7	—	—	—
Ground Provisions, value	$776 50	—	$16	—
Kola-nuts, cwts. ...	—	—	—	—
Rice, tons ...	1,246	1,084	1,650	701
Rice-meal, tons ...	—	382	460	124
Starch, cwts. ...	—	—	—	—
Cattle, head ...	289	115	259	181
Hides, No. ...	761	742	1,362	1,414
Pigs, No. ...	—	108	266	196
Poultry, value... ...	$ 133.64	$ 3.12	$ 16.68	—
Sheep, head ...	1	—	6	18
Balata, cwts. ...	791	486	·488	647
Charcoal, bags ..	19,311	22,708	17,612	17,778
Firewood, Wallaba, etc., tons ...	1,968	2,201	2,166	2,557
Gums, lbs. ...	264	—	192	787
Lumber, feet ...	6,196	6,606	32,182	104,321
Railway Sleepers, No.	500	1,000	—	1,000
Rubber, cwts. ...	17	7	7	4
Shingles, thousands	889	194	380	929
Timber, cubic feet	111,755	99,920	78,451	58,096

Selected Contents of Periodicals.

Spraying Experiments with a Lime-sulphur Summer Wash.
Agri cultural Education in the United States and Canada.
The Cultivation of the Sugar Beet.
Tomato Cultivation for Allotment Holders.

—The Journal of the Board of Agriculture (England), Jan and February, 1911.

Tobacco Culture (in Victoria).
The Nature and Use of Hard Seeds.
Feeding Cows for Milk Production.

—The Journal of the Dept. of Agriculture of Victoria (Australia), Dec., 1910 and Jan., 1911.

Spraying for Weeds.
Influenza in Horses.
A Machine to Destroy Thrip.
The Rain Tree of Peru (Pithecolobium Saman).
The Pineapple Canning Industry.

—The Queensland Agricultural Journal, Nov., 1910, and Jan., 1911.

Para Rubber in Southern Nigeria.
The Poisonous Properties of Immature Sorghum.
Production and Use of Coca Leaves.

—Bulletin of the Imperial Institute, Vol. VIII., No. 4.

The Interpretation of Experimental Results.
Fungicidal Properties of Liver of Sulphur.
"Fatness" as a Cause of Sterility.

—The Journal of Agricultural Science, Dec., 1910.

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